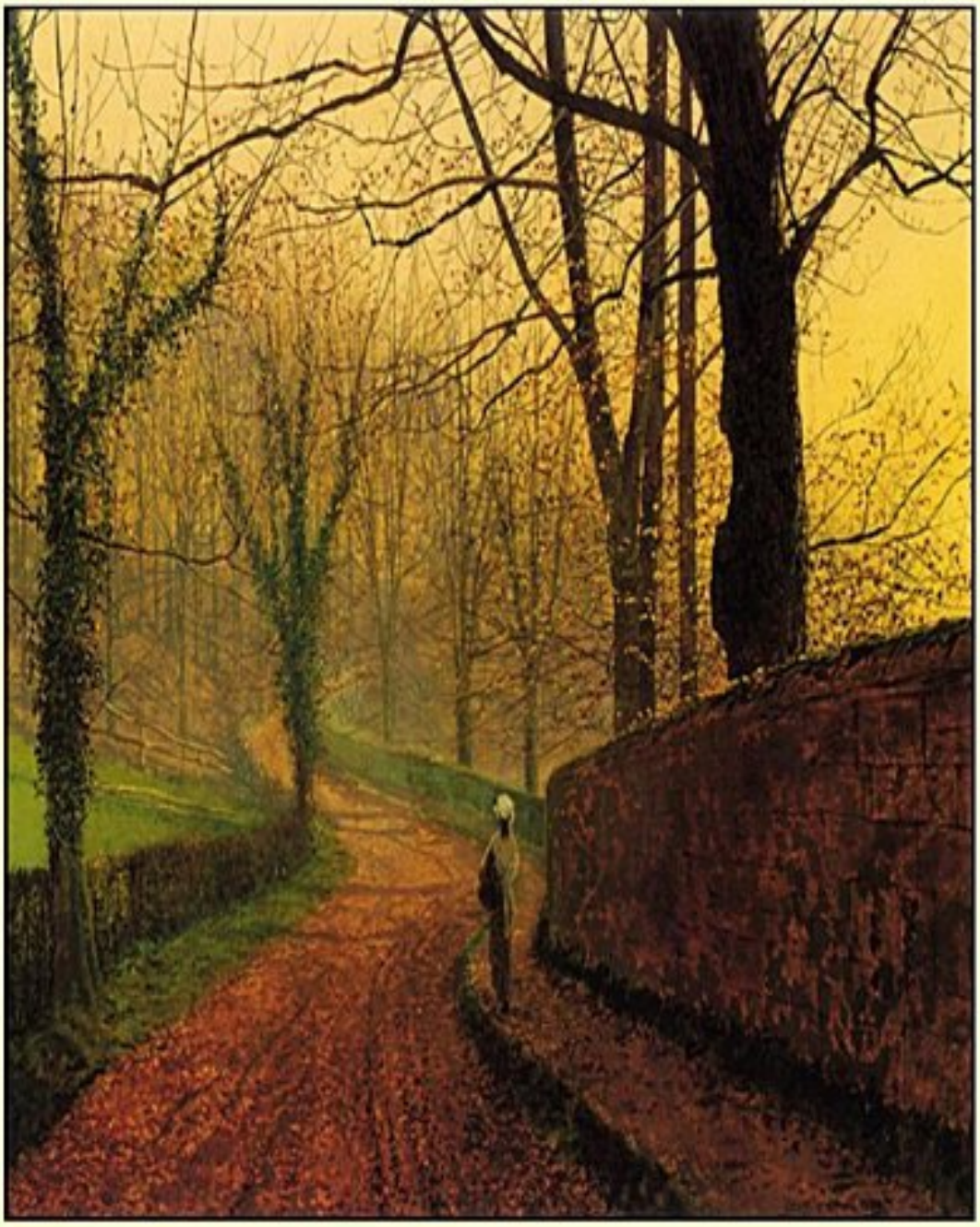
A Journey to the Earth's Interior

Marshall B. Gardner



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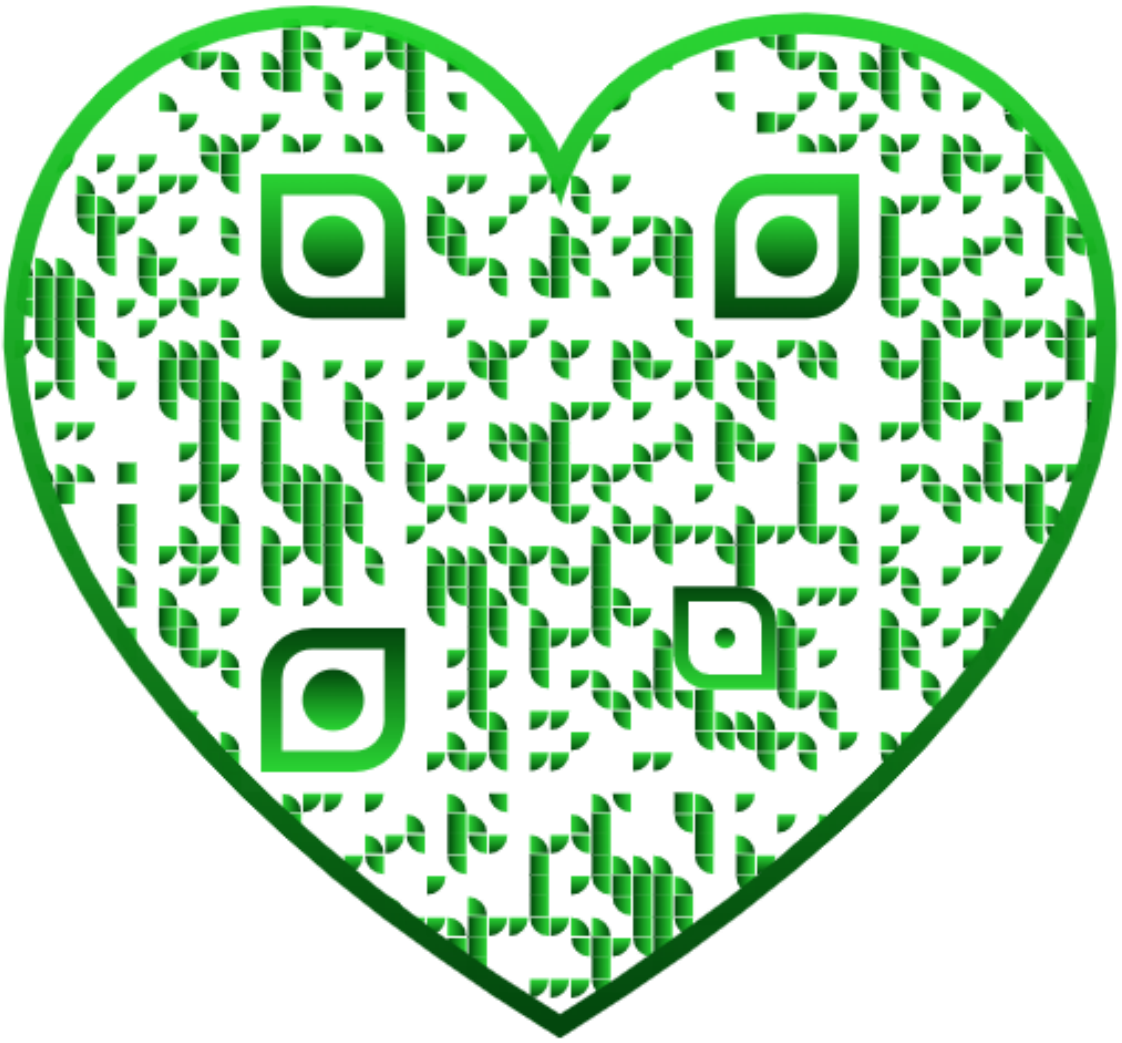

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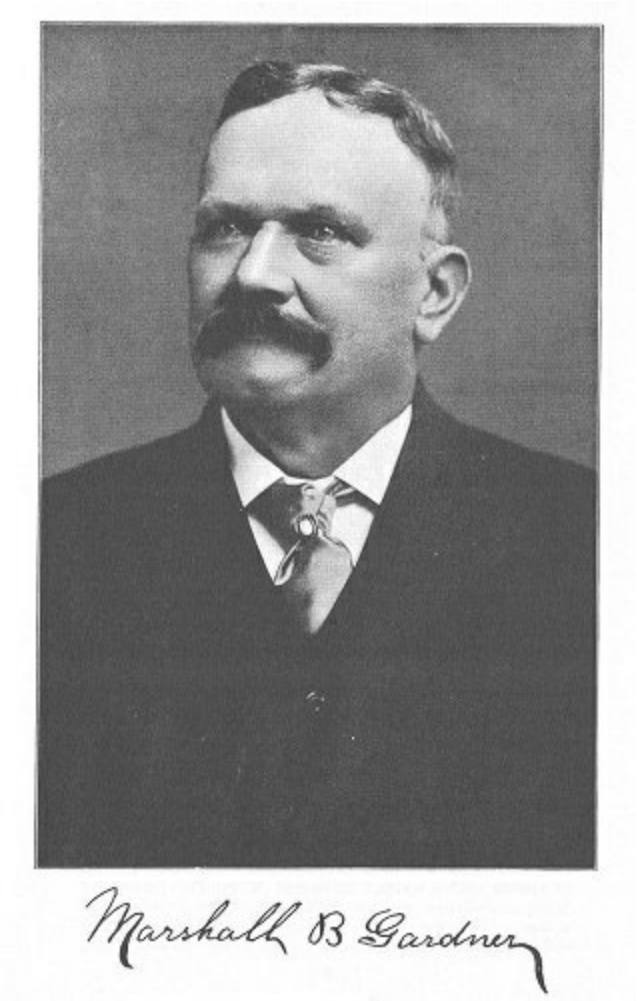
DEDICATION

DEDICATED TO THE CONTINUED PROGRESS OF SCIENCE AND THE SERVICE THAT IT CAN RENDER TO HUMANITY



PREFACE

THE MAN whose acquaintance with cosmogony and physiography is confined to what he learned in school, and, perhaps, afterward read in popular publications, has certain very definite notions about the shape of the earth and the construction of its interior. These notions, he thinks, are based upon the proven discoveries, or the impregnable theories of the scientists, and so he accepts them in blind faith. But the scientists themselves do not rest under the impression that they have solved every mystery that is buried in the bowels of the earth. While they hold to a general theory about the shape and constitution of the earth, that it is a rigid solid--a theory which is now beginning to supersede the older theory that it was a shell with a liquid interior--they admit that there are many questions raised by recent observations of facts that cannot be explained by their present theory.

To the scientist then, and also to the layman whose interest and encouragement may do much for scientific advancement, when he sees in what direction it is tending and what results it may have, are the following pages addressed. In them will be found a recital of certain well known and fuly authenticated facts of geography, exploration, and astronomy which have not been satisfactorily explained by any of the theories of the shape and constitution of the earth so far held. Then, on the basis of these facts, a new theory is presented which I claim does explain them; does make them fit in with the accepted results of scientific investigation, and which does not conflict with any other relative facts in the world, but unites them all in an intelligible manner.

WANTED--A FAIR HEARING

In any such attempt as this two tendencies have to be overcome before an author can secure a fair hearing. The first is the conservatism of scientists who do not care to revise their theories--and especially when that revision is made necessary by discoveries which are made independently of the great universities. I think, however, that the array of confirmatory evidence which I have brought to bear upon my position will be sufficient to counteract this conservatism and induce scientists to give my theory a respectful hearing and

full discussion. The second adverse tendency which must be overcome is the erroneous notion of the general public that a scientific theory or hypothesis is, in reality, a final truth that must not be denied. The layman imagines that the scientists have some mysterious means of discovering the actual truth, and that once discovered it is final. In this matter of the composition and shape of the earth, for instance, he thinks that the scientists actually know that the earth is a ball of a certain density and composition. Only a short time ago, however, the scientists thought that the earth was a solid shell with a liquid interior--and any layman would have sworn this was true just because the scientists imagined it. Nov the real fact of the matter is--and any scientist will admit it that a scientific theory, such as either of the two just mentioned, does not represent an ultimate truth. It is simply an essay of the imagination to weld certain facts, which are not apparently related, into some sort of connection. For instance, we have the facts of gravitation, electricity and light, all acting thru great spaces--and all having what are apparently common properties. To explain their action the scientists build up theories of wave motion through the ether. Now the layman accepts the luminiferous ether as a finality. But the scientist might discover some fact tomorrow which could not be explained on that assumption of a universal ether, and so he would have to construct a new theory more comprehensive than his former one, and which would make room for the new fact. I do not imply that such a theory is either likely or possible, but I simply give this as a convenient example of the same thing which I have done in the domain of cosmogony. And my point is, that a theory is good so long as it gives us such a view of the matter as will enable us to discover new facts, but good for that purpose only.

AN ADVANCE ON COPERNICUS

The copernican system of astronomy was a step in advance of the Ptolemaic system just because it enabled scientists to discover many new facts about the solar system which the error of the old view had hidden from their gaze. My own theory adds to the valuable results gained by the Copernican system, not by subverting it--for I imagine that no sane person would now try to do that--but by accepting it fully, and adding to it a different theory of the evolution of the several planets from their nebula, and from this new theory of evolution deducting certain presumptions about the interior of the earth. These presumptions I have supported by a wealth of

facts discovered by the telescopic observations of astronomers of nebulæ and our sister planets, Mars, Venus and Mercury, and made by explorers of the most fascinating parts of our own planet--the polar regions.

In conclusion I would ask the reader to remember that I do not write as a scientist or claim to be a scientist. I simply claim to have applied the lessons of common sense to these problems. I do claim to have studied all the material, to have gathered my facts carefully. But there is nothing in my book that the layman cannot understand. It is written by a layman for him. It is to his common sense that it appeals.

The .

Aurora, Illinois.

CHAPTER I. INTRODUCTORY

An author who puts forth a new idea must expect to meet with opposition and be ready to defend his idea vigorously. He knows that the great mass of people is very conservative, especially in its habits of thought and that it is inclined to take many things--the shape of the earth, for example--as proven once and for all. But he also knows that the great reading public even more than the specialist in science is open minded and willing to give a fair hearing. He will expect some opposition and some misunderstanding but he may also expect a slow, perhaps, but sure volunteering of support.

A NEW IDEA AND A PLEA FOR ITS FAIR HEARING

The author of the present work has set forth in it a theory which is not only new that in itself would not necessarily cause opposition in a world which is always hungering for some new thing--but it is a theory which involves the denial of a number of ideas which are old and widely held and often held by people who do not understand their bearing. These people will defend them with such weapons as ridicule or perhaps misrepresentation.

THE TRAINED SCIENTIST AND THE AVERAGE READER

From trained scientists on the other hand the author expects to meet with greater prejudice than from the public, but he does expect that any criticism they may have to make upon this theory will be made from a purely scientific standpoint, that his idea will not be dismissed simply because he is not a professional explorer or astronomer. Unfortunately scientists often do this. They have their professional freemasonry. If you are not one of them they do not want to listen to your theories.

But to the man in the street the author wishes to say this: there is not in the whole course of this book a single statement that is not backed up by the actual experiments, observations, discoveries and reports of these same scientists. They cannot claim that the theory expounded in this book is an unscientific theory, for every bit of it is solidly based upon their own findings. Our theory may be untrue, but if it is, then the findings of Nansen

and every other Arctic explorer, of Sir Robert Ball, Percival Lowell and every other astronomer, are wrong. For upon the work done by these men and upon no other considerations whatsoever than those of pure scientific knowledge are the ideas in this book built.

Let us then address our first words to the average reader whose support we wish to gain because public opinion will move in time even the most conservative of scientists; because public opinion is the court of last resort in every case; because the public will demand a fair hearing when the orthodox scientist would tend to ignore this as in the past they have ignored many beneficial discoveries and ideas until they were forced to accept them.

Most members of this public to whom we would appeal have very definite notions about the shape and constitution of the earth, but unfortunately these notions are not as accurate as they are definite, being the fruit usually of what was learned in school some years ago or of what has been read in popular and inaccurate text-books or magazine articles.

OLD IDEAS ABOUT THE CONSTITUTION OF THE EARTH

Now as a matter of fact the scientists themselves no longer hold the ideas about the constitution of the earth that were taught in all text books only a few years ago. The notion that the earth is a great ball of material which has hardened into a shell or crust on the outside but which is full of molten material within, getting hotter and hotter as we reach the center--that notion is now no longer generally held. And no other theory has quite taken its place. Some scientists think that the earth is a rigid solid we shall see later how both schools have explained volcanoes but others disagree with them, and think that while the earth may have a solid center that it does have a liquid hot layer somewhere between its center and its surface. But into these rival theories we need not go now. We only adduce them to show the reader that there is room for another theory; that the field is open and explanations of the constitution of the earth are really called for--for none of the theories up to the present have explained all the facts.

Of course it is very easy for anyone to deny all the facts of science and get up some purely private explanation of the formation of the earth. The man

who does that is a crank. Unfortunately the man in the street does not always discriminate between a crank and a scientist. At one time Orville and Wilbur Wright were called cranks because they admitted that they were trying to do something new, something that had never been done before. Many scientists said that flying was an impossibility for human beings; that they were not meant to fly and never would fly. The Wright Brothers did not retort by saying that science was wrong, and then do a lot of silly and unscientific experiments. Had they done that they would have injured themselves. On the contrary they opposed their better and more thorough science to this old-fashioned and reactionary science. So we meet the objections which the older scientists bring against our theory with better and more up to date science. In that way, although we deny that the usual idea of the formation of the earth is correct we are not in the same class with a number of other people who have denied it. There is one man who has stated that the earth is an immense hollow sphere and that mankind and the land and oceans and even the stars are all on the inside of it. But he is a crank for he has simply taken his private notion, evolved within his own brain and has made a religion of it. We beg the reader that he will not confuse us with any of that sort of theorizing. If the reader says, "You believe in a hollow earth--oh yes, that is what Koresh taught," he is doing us a grave injustice, even though it be true that we claim the earth to be hollow.

CRANKY IDEAS ARE NOT IN SAME CLASS WITH

SCIENTIFIC ONES

It will also be an injustice to us if the reader confuse our idea of a hollow earth as presented in this book with one or two theories which have been put out in the past and which only bear a superficial relation to ours. For instance, nearly one hundred years ago in America a theory was put forth that the earth consisted of a number of concentric spheres one within the other. Now that could hardly be called a scientific theory. It was based on a supposition, and the author argued from his supposition down to what the facts ought to be. He said in effect, "According to my principle there ought to be within the earth a series of spheres each one inside the other". But he did not know, and he never went down to see.

We take the opposite course. We begin with the facts. We claim that the earth is a hollow body with an immense opening at each polar axis--an opening about fourteen hundred miles in diameter and that there is in the interior of the earth a sun which warms it and gives it light. But we do not say this in the first place and then say that it follows that there is warmth in the polar regions where the scientist has told us it is cold. On the contrary what we do is quote every Arctic explorer from the fishermen of a hundred years ago to Franklin, Kane, Nansen and Peary, to the effect that there is warmth at the polar extremities of the earth. We state that this formation of a hollow shell around a central sun, with polar openings, is not alone the formation of the earth but of every planetary body throughout the stellar universe. Why do we say that? Because we think it ought to be? Because we wish to impose our own idea on to the facts? No, but because we can see those polar openings and occasionally the gleam of that central sun as we look at Mars or Venus through a telescope. And so it goes. In every assertion we make, we first gather up all the available facts, and the theory of which we write is not so much a theory that we put forth as it is a theory which the facts put forth to us when we examined them. We did not set out with our theory full blown. We set out with a great desire to understand the facts of astronomy and of the earth's formation. We had read this and that about it and were struck by the uncertainty of what we had read. We asked ourselves whether, if we knew all the facts, we would still be puzzled, as we were, by accounts of warm currents flowing from the North Pole and other contradictions of accepted science. Having asked ourselves that, we set out to ascertain all the facts that

had any bearing on the case, just as the Wright brothers set out to ascertain all the facts that would bear on their problem. And it was the facts in the case, the inexorable and unalterable facts, that made our theory for us.

So we ask any reader, especially any scientific reader, who does not believe our theory upon reading this book, not merely to make fun of it, not merely to deny its possibility, but to produce facts which will prove it wrong, and then--supposing he can do that which we doubt--to explain all the facts put forth in this book, to explain all of them, we say, by the light of any other theory. It might be easy enough to explain one or two of our facts in some other way. But to explain them all is impossible on any other theory than ours.

OUR THEORY IN A NUTSHELL

That the reader may get our theory in a nutshell, that he may comprehend before he undertakes to read the whole book how widely we have searched for the material of our foundation we shall briefly recapitulate here the main outlines of our theory. As already stated we hold that the earth is neither solid nor fluid inside but that it is a hollow shell of a thickness which, provisionally, we should estimate to be 800 miles, with an opening at each polar extremity of approximately fourteen hundred miles across. The interior sun which warms this inner earth may possibly be 600 miles in diameter, although we have of course no means of actually measuring it as yet. Why do we postulate such a sun? The answer is the key to our whole theory. As the reader may know, the orthodox astronomer explains the evolution of this earth by saying that the earth, the other planets which revolve around its sun and that sun itself were all once intermingled gas in a white-hot or incandescent condition, whirling around at an enormous rate. As this mass whirled it gradually became a vast spiral owing to the play of centrifugal forces pushing it away from its center or nucleus and gravitational forces holding it within the influence of that center. This went on, according to the scientists, until the gas arranged itself in a series of concentric rings around that center. Then each ring broke and formed into a sphere which gradually cooled off until it liquefied and then solidified on the outside, forming a planet while the central nucleus became a sun. This is known as the nebular hypothesis of the evolution of the solar system. But for many reasons, which

will be taken up in detail later, our observations lead us to put forth a different theory.

Briefly our theory is that the original nebula did not break up into a solar system but condensed into one planet. From observations of nebula which are at this moment in various stages of their evolution we are forced to the conclusion that the rotating mass of gas, breaking off from its central nucleus forms an envelope of a roughly spherical shape which afterwards solidifies, leaving the central nucleus still in the center to form an inner sun. Why there should be the two polar openings will be explained in the chapter in which the foregoing assertions are proven.

OBSERVING THE PLANETS

The next step in the proof of our theory is to scan the planets to see if indeed they do have this formation, and as Mars is the most easily observed of them we look at that first. Mars does have two polar openings--although up to the present time they have most often been called ice or snow caps. But when we find the scientists themselves quarreling over that appellation and some of them proving that the polar caps of Mars cannot be of ice or snow at all, we begin to think that perhaps our theory is the correct one. But we do not have to rest satisfied with thinking so. When the late Professor Lowell, the astronomer who spent much of his life studying Mars--when this great authority states that he has seen gleams of light coming out through the so-called polar cap of Mars, then we know that it cannot be an ice-cap and that those gleams must be from the interior sun of Mars.

And if further proof be needed--and our policy is to overlook no scrap of available proof we have only to observe Venus and Mercury to have our previous observations confirmed in the case of those planets also.

OBSERVING CONDITIONS ON THE EARTH

Bearing those very significant facts in mind we next come down to our own earth. If our facts are to be the same for every planet we shall find the same conditions here as there, on earth as on Mars. That actual solid poles have never been discovered in the earth's Arctic and Antarctic regions we shall prove in another chapter. Here we shall briefly summarize our evidence.

It is to the effect that as explorers go north of about 80 degrees north latitude, they find that the water instead of becoming colder in the same ratio in which it had been getting colder as they left the temperate zone, gradually begins to get warm again, and they find that this warmth is brought down from the so-called frozen north in a warm current flowing from the polar regions. Furthermore they find that birds and animals migrate to the north to feed and breed instead of to the south. In fact when they get into really high latitudes, explorers find a greater wealth of animal and vegetable life than they do in the lower latitudes of the arctic and sub-arctic regions. And as they are sailing to these northern regions they find, scattered on the icebergs and glaciers, the red pollen of plants that grow where? Only in the interior of the earth. And they find logs and other debris of the land washed down in those warm currents just spoken of. But this is not all. In our chapter on the mammoth and mastodon we shall adduce evidence to show that the mammoth still lives in the interior--in fact we shall exhibit case after case where the mammoth has floated out from the interior incased in glaciers and bergs and has been frozen in crevasses in the interior near the polar openings, and then carried over the lip by glacial movements into Siberia.

Other evidence we shall give in abundance but we shall not summarize it here because we imagine that the reader is already bristling with objections to what we have already said, and we wish to answer such of these as can be answered in advance of our main argument. If we mistake not the reader is more willing to accept our evidence drawn from the nebula and Mars than he is to accept that drawn from the earth. For the first two regions are but little known to him, as he has never possessed the high-power telescopes that are necessary to explore the nebula and the planets; but he has read the newspapers and magazines and "knows" that Peary or Cook discovered the Pole (to say nothing of Antarctic explorations).

PEARY AND THE POLAR ORIFICE

Why, says the reader, did Peary not discover that immense orifice at the polar extremity of the earth if it was there?

The reason is very simple and can best be explained by asking another question.

Why did not man discover by looking around him, that he was living on the surface of what is, practically speaking, an immense sphere (to be exact spheroid)? And why did man for centuries think that the earth was flat? Simply because the sphere was so large that he could not see its curvature but thought it was a flat surface, and that he should be able to move all over the surface of it appeared so natural that, when scientists first told him it was a sphere he began to wonder why he did not fall off, or at least, if he lived in the northern hemisphere, he wondered why the Australians did not fall off--for he had no conception of the law of gravity.

Now, in the case of the polar explorers the same thing is true. They sail up to the outer edge of the immense polar opening, but that opening is so vast--remember that the crust of the earth over which it curves is eight hundred miles thick--that the down-ward curvature of its edge is not perceptible to them, and its diameter is so great--say 1400 miles--that its other side is not visible to them. So that if an explorer went far enough he could sail right over that edge, down over the seas of the inner world and out through the Antarctic orifice, and all that would show him what he had done, would be that as soon as he got inside he would see a smaller sun than he was accustomed to--only to him it might look larger owing to its closeness--and he would not be able to take any observations by the stars because there would be neither stars nor even a night in which to see them.

So let the reader have no misgivings that any rash explorer will "fall into" this aperture.

But, says the reader, would not the force of gravity pull the explorer who got inside the orifice away from the surface into the central sun; for does not gravity pull everything to the center of the earth?

GRAVITATION AND OUR THEORY

The answer to this is, that in gravitational pull it is not the geometrical position that counts. Center, in the geometrical sense of the word, does not apply. It is the mass that attracts. And if the great mass of the earth is in its thick shell, it is the mass of that shell that will attract, and not a mere geometrical point which is not in the shell at all, but 2900 miles away from it, as that is the approximate distance between the central sun and the inner

surface of the earth. As a matter of fact it is the equal distribution of the force of gravity all through the shell that keeps the sun suspended in the spot which is equidistant from every part of that shell. When we are on the outside of the shell it is the mass of the shell that attracts us to its surface. When we go over to the inside of the shell that same force will still keep our feet solidly planted on the inner side.

FACTS NOW GATHERED FOR THE FIRST TIME

These, we think, are the chief objections which people are likely to raise when they first learn of our theory, and it will be noted that they are based on misconceptions of the theory. For this reason we urge every reader to follow all our argument if he wishes to understand it. He will find that the facts which we adduce in support of it, are in themselves very interesting. We have nowhere indulged in too technical language, and all the authorities we have quoted are trained, reliable scientists whose word may be taken, whose word, in fact, is always backed by actual discovery and experiment. As a result the reader will not only learn the true formation of the earth and be able to follow with interest and understanding the explorations which will before long undoubtedly be made by airship, but he will learn some of the fascinating truths of astronomy and will have a picture before him of actual conditions in the Arctic regions. In fact, apart from the new theory here explained for the first time, we know of no other book which brings to the non-scientific reader so many facts which are not to be obtained elsewhere in book form. For, unfortunately, the text-books never keep up with the new discoveries. Books printed some years ago in which the earth is represented as a mass of molten lava contained in a thin crust, are still circulating when scientists have given up that conception. Such facts as we have gathered about the mammoth and other animals are also not yet incorporated into the books that the average man reads. To every reader then, we can promise not only our theory but a large range of the most interesting facts about the world he dwells in and the worlds that circle around in the heavens that he gazes upon in wonder and speculation. And we ask of the reader a patient reading without prejudice, and that he follow it by thought and speech--to the end that, if he be convinced by our reasoning, he may pass on the word and help to find an audience for this new idea that sufficient interest may be aroused to turn the idea speedily into an ascertained fact by the simple process of exploring the

polar land we have depicted, and putting our theory to the test.

THE FINAL TEST

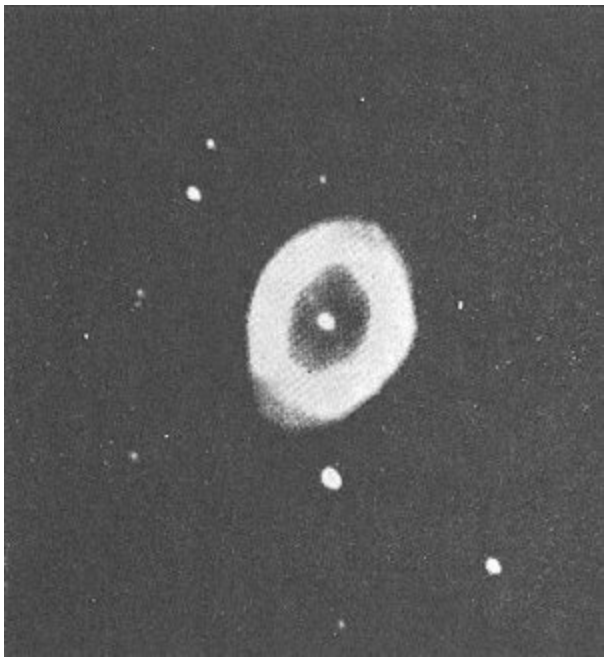
That it will stand this test; that the interior of the earth will be opened up to our exploration and traffic and observation as we have in this book opened it up to thought, is our confident belief.

CHAPTER II. THE NEBULA AND ITS EVOLUTION

Probably the most important concept in the whole realm of astronomy is that of the nebula; for it was only when the idea of the nebula as the original material of planetary evolution was advanced, that astronomy could be put upon a really scientific basis. Until the actual genesis of solar systems and planets could be accounted for in some measure, astronomy was merely descriptive. The credit for stating the nebular hypothesis goes to Kant and Laplace, who, however, based their speculations upon the law of gravity only. Since that day the nebular hypothesis has undergone many modifications, as actual observation of the heavens through telescopes and later through photographic means, to say nothing of our general knowledge of physics, has progressed.

HOW CELESTIAL BODIES ARE DERIVED FROM NEBULAE

The latest modification of the theory of how other celestial bodies are derived from nebula is the one proposed in this book. That the reader may understand both the original theory and the chain of logic and observation by which this new theory grows out of it, we shall briefly summarize the older ideas, giving the scientific authorities for them, and showing how these authorities have gradually worked to a point, without knowing it, of course, where our theory and ours alone, fits all their facts and draws them together in a consistent explanation of what is actually happening in the heavens as the stars form and go through their immensely long life-cycles.



Photographed at Lick Observatory

The ring or hollow shell nebula in Lyra was evolved from masses of nebulous matter, showing the polar opening and central sun, which will finally evolve itself into a new planet.

Photographed at Yerkes Observatory, January 3, 1912

A spiral nebula showing the central nucleus projecting masses of nebulous matter which forms a ring or wall around this central body, as clearly shown in the accompanying reproduction of a ring nebula.

THE MILKY WAY AND ANDROMEDA

But the reader will first wish to get a very general idea of the field we are to discuss in this chapter. Probably to most people the word nebula conveys an idea almost as hazy as the Milky Way to the naked eye. In fact many people think that the Milky Way is a nebula and let it go at that. Others think that nebula are merely clusters of very distant stars--such as we do see in the Milky Way. But as a matter of fact there is only one nebula in the whole sky that can be seen without the aid of a telescope, and that is the so-called "Great Nebula in Andromeda". Of this nebula, George F. Chambers, in his little book, "The Story of the Stars," says:

"There is one elliptic nebula which stands out beyond all the rest, yet its

great size, brilliancy, and peculiar features forbid its being regarded as a typical elliptic nebula. I am here alluding to the 'Great Nebula in Andromeda,' Messier's 31st. Its ellipticity is considerable; it is likewise very long, and has a bright central condensation which renders it readily discoverable by the naked eye on a clear night."

Of course, with the naked eye we cannot see any details, but with the telescope this nebula is found to have a well defined structure, and all other nebulæ are found to have certain structural characteristics in common, the nearer ones giving every evidence, as we shall see later on, that they are not clusters of stars at all that idea having been absolutely exploded.

ARE NEBULAE STELLAR OR GASEOUS?

We need to accentuate that last point because it is still overlooked in many of the more popular books. Thus in Mr. Chamber's book just referred to, the author begins his chapter on nebulæ by saying that "many or most are probably stellar in their constitution, though some of them, however, may be not such but gaseous." As a matter of fact a few of the early discoveries of glowing masses in the sky were thought to be nebula but later research has shown them to be extremely distant star-clusters, so far away that only the highest power telescopes would resolve them, some so far away that we cannot resolve them at all into their constituent stars. Then how, asks the reader, can you tell that all nebula are not stars?

THE SPECTROSCOPE SUPPLIES THE ANSWER

The answer is, by the spectroscope. Later on in this chapter we shall see astronomers referring to this instrument and its discoveries more than once--in fact on it depends our whole theory in a way, for if the nebulæ were really stars our theory would fall to the ground. So a word here may not be amiss.

The spectroscope is simply a prism with a sort of small telescope at one side of it, through which is led, by suitable means, the light from any object from a candle flame to a star. At the other side is a barrel containing other lenses which act more as a microscope and magnify and define the ray of light which has been led into the prism. Now a ray of white light is split up by the prism into the seven colors of the rainbow, and the light of a candle

flame is split up in-to its constituents. Also when any chemical substance is burned and the incandescence from it's burning is analysed in this way, we can read by the colors of the broken up light just what elements are present in the chemical substance. In this way we can identify the elements in the sun and in other burning or incandescent heavenly bodies. And the light from bodies like the stars gives one sort of "spectrum," as the colored band of broken light in the prism is named. And the light from nebulæ gives an altogether different sort of effect, due to the presence of luminous gasses. Thus the spectroscope has proven absolutely that the nebula is not made up of stars.

SIMON NEWCOMB ON LAPLACE'S THEORY

As Simon Newcomb summarizes the matter in his "Popular Astronomy," Laplace observed that the planets moved around the sun--of our solar system--in the same direction in which the sun rotates on its axis, and in the same plane. Laplace explained this uniformity of motion by assuming that once the atmosphere of the sun had occupied all the space now occupied by the planets of the solar system. From mechanical laws he knew that the sum total of rotary motion must at all times be the same in the same system. In the beginning, therefore, he assumed, the sun with its immense fiery atmosphere had a slow rotation upon its axis. The mass, being extremely hot, would cool off and as it did so would contract toward the center. But as it contracted its velocity of rotation would increase--that is a fundamental law of physics--so that at a certain time the mass would be whirling so rapidly that the centrifugal force due to the rotation--the force, that is, that causes a weight whirled at the end of a string to fly away when one releases the string--would counterbalance the attractive force of the central mass. Then those outer portions would be left as a ring, rotating around the center, while the inner portions would continue to contract until in their turn their velocity caused them to stay on a circular course of their own, forming an inner ring. In this way a succession of rings would be formed, revolving around the common center in the same direction.

Soon, however, these rings would begin to cool off, and as their denser materials would cool sooner than the others and begin to condense; then the denser parts would attract the less dense parts, by gravitation, and at last we

should have a single solid mass surrounded by vapor, revolving around the sun at the same distance and in the same plane in which the ring had revolved from which it was derived. Laplace thus accounted for the evolution of a whole solar system from a nebula, and in the same way he accounted for the formation of the satellites that surround the planets in some cases as the planets surround the sun. In the case of the planet Saturn, he observed that the gas of the rings was so uniform in density that none of it had cooled in advance of the rest, and so the ring has remained as we see it today through our telescopes.

PROFESSOR MOULTON CRITICIZES LAPLACE

But there were weak places in Laplace's hypothesis. If we turn to Professor Forest Ray Moulton's "An Introduction to Astronomy", page 454, we shall find these objections summarized. The author, in collaboration with Chamberlin in 1900, studied the problem from actual observations tested by the principles of dynamics, and found a number of phenomena that contradicted the hypothesis. We need not enter into all of these, but one or two of them are very important from our standpoint. For instance, if a ring were formed as Laplace supposed, "it would be so widely extended that the mutual gravitation of its parts would be very feeble, and according to the kinetic theory of gases"--which describes how their particles repel one another and states the laws governing that repulsion--"the lighter elements would escape. But the lightest known element, hydrogen, is abundant on the earth, though it is now in chemical combination with other elements". It is also very doubtful, according to Moulton, whether the rings would condense into masses in the way Laplace assumes. And Moulton further thinks that the theory is rendered quite untenable by the fact that the amount of rotation which the whole nebula originally had, and which in its present evolved form it still ought to have (according to the law of the conservation of energy) is only one two-hundredth of what it ought to be. So Mouton dismisses the Laplacean hypothesis and then goes on to discuss its successor, Chamberlin's Planetesimal hypothesis or Spiral hypothesis, in which it is assumed that the solar system is evolved from a spiral nebula.

TELESCOPIC OBSERVATION OF NEBULAE

But before going into that, let us see what the nebula are actually like when studied by telescope and telescopic photograph. Let us see what a spiral nebula is and what other forms beside the spiral they take. One of the best general descriptions of the various forms of nebulæ will be found in "Curiosities of the Sky" by Garrett P. Serviss, chapter VI. In 1899, Garrett tells us, Professor Keeler discovered, by photographing them, that the majority of nebula were not only glowing masses of gaseous matter, but had definite forms. They were, for the most part, spiral with a central nucleus, and while there are other forms of nebula, the "ring" and the "planetary," it is a question, says Serviss, whether every nebula has not at least a tendency to be spiral. But at least, Serviss says the ring and planetary nebulæ serve, insofar as they exist at all, to support Laplace's theory, while the spiral nebula apparently play into the hands of Professor Chamberlin and his planetesimal hypothesis.

DO THE NEBULAE POINT TO A NEW THEORY?

If now we approach the nebula with mere detailed examination, can we see anything common to all forms of nebula, something which might lead to a theory which is neither that of Laplace nor of Chamberlin. To answer this question let us turn to a very detailed description of the nebula, that of the great English astronomer, Sir Robert Ball, given in his wonderfully illustrated volume, "A Popular Guide to the Heavens". Here is his description, accompanied by a plate, of "The Spiral Nebula in Canes Venatici".

THE SPIRAL NEBULA IN CANES VENATICI

"This, the most famous of the Spiral Nebula, had its true character first recognized by Lord Rosse with his great reflector at Parsonstown in Ireland. We are so happily situated with respect to it that we get a fair view of it, and can trace in considerable detail how its branches are interlaced and studded with condensations which look as if they are on the way to become stars. Recent photographic work has shown that a large proportion of the nebula, both known and hitherto unknown, are spirals, and this form must now be considered almost the rule instead of the exception".

Our only observation here would be that the condensed portions are

certainly not destined to become stars or planets but that they are destined to become central suns of planets.

THE GREAT NEBULA IN ORION

Of "The Great Nebula in Orion" Professor Ball says:

". . . And in this, as in many nebula, we find black holes with edges surprisingly sharp which are very hard to explain, except upon the highly speculative assumption that they represent dark material structures of some kind interposed between us and the shining nebula."

The observation there, is a most interesting one. Its explanation may be rendered unnecessary by our own further consideration of the matter.

THE RING NEBULA IN LYRA

But here is Professor Ball's most interesting description, that of "The Ring Nebula in Lyra": "The central star which is so conspicuous in the photograph, is barely visible in the largest telescopes.

It is much brighter photographically than visibly, probably because its light is composed chiefly of those rays of short wave length to which the plate is sensitive but the eye nearly insensitive.

"The photograph shows quite plainly that the ring is not uniformly bright; there are even some indications that it is composed of several interlacing or overlapping rings, and it is remarkable how the ring thins out at the ends of its longest diameter. 'With longer exposures the center of the ring fills up, and the nebula becomes a disc. It follows that the ring-like appearance is in a sense deceptive; that the real shape of the nebula is something like a hollow shell of gas. Of which the border looks brighter, perhaps, because one is then looking through a greater depth of the shining matter; but this is at best a conjecture."

THE DUMB-BELL NEBULA

Professor Ball also describes the nebula which was discovered to be

whirling around the star Nova Persei in 1901 in which the existence of the nebula was unnoticed until it was illuminated by a burst of light from the star. But perhaps the most remarkable photograph of a nebula in his book is that of "The Dumb-Bell Nebula," in which the spherical character of the nebula with the two large and not well formed openings at the two ends of a diameter--that is at opposing poles--are plainly seen. And Professor Ball himself recognises the kinship of this nebula with that of "The Ring in Lyra" described previously, for he says:

"It is a striking illustration of the power of photography in depicting nebula, that it has brought out a distinct resemblance between the Dumb-Bell in Vulpecula and the Ring in Lyra which could hardly have been suspected from the visual appearance of these objects. If we imagine the nebulosity, which exists inside the ring, to shine a little more brightly, so that it fills up the Ring, and at the same time imagine the tendency towards thinning out at the ends of the longest diameter to be a little more pronounced, we shall see how easily the ring might be transformed into the Dumb-Bell. Both are gaseous and both have a central star. It is difficult to resist the conclusion that the two nebula are closely related in kind."

THE EVIDENT EVOLUTION OF NEBULAE

What does that mean but that the nebulæ are evolving toward a certain form? Toward a form that is roughly suggested by the last described nebula with its spherical skin broken at two opposite poles and its central star, or, why not call it its central sun?

Sir Robert Ball then gives us a link between an annular and what may be called a planetary nebula. Fortunately we are able to pursue the subject a little further. Writing in the *Scientific American Supplement,* Vol. XXXIV, page 13909, Miss A. M. Clerke tells about the advances in observing planetary nebula made possible through photography. By photography the lines in the nebular spectrum can be examined and the central nuclei are seen to be masses of luminous gas, on its progress toward condensation. It will have been noticed that some of the investigators quoted, refer to these nuclei as stars. If they had really been stars seen through the haze of the nebula itself, then good-bye to our theory. But here Professor Moulton may be quoted in corroboration:

"All the nebula except the spirals have bright-line spectra instead of dark-line spectra like those of the sun and stars. This shows, in accordance with the principle of spectrum analysis, that the nebulas are masses of incandescent gas rather than luminous solids or liquids shining through cooler gases. Be-fore these results were obtained by the spectroscope it was supposed that perhaps the nebula were other galaxies of stars so far away that their individual members were not separately visible. The spectroscope, however, proves they are gaseous and this conclusion is in harmony with other considerations regarding the evolution of suns."--*Descriptive Astronomy*.

But to return to Miss Clerke. She, too, refers to the nebula in Lyra whose description by Ball we have quoted. When it was photographed by a French astronomer, M. Trepied, it was found that the difference between its type and that of the planetary nebulæ was more apparent to the eye than real by the test of the camera. And in fact, she goes on:

"The distinction between annular and planetary nebulæ has been to a great extent abolished by the use of improved optical appliances. Each kind seems to be made up of three essential parts: a faintly shining disc--or globe projected into a disc--a ring-like condensation near its outer margin, and a central nucleus presenting the appearance of a star. The last feature is often seen only with extreme difficulty, but there is reason to believe that it always exists. Mr. Burnham, who has measured a large number of these objects with the 36-inch Lick, for the purpose of providing a standard of comparison for the determination of their possible future movements, goes so far as to suggest that the presence of a central star should be regarded as the criterion of classification for planetary nebulæ."

BURNHAM IN CENTRAL NUCLEI

Miss Clerke then quotes Burnham to the effect that he considers these central nuclei to be true stars, that is to say, stars already formed irrespective of the gasses that surround them; and she goes on to show, through photographic data that they are not true stars at all. She gives Professor Holden's description of the nebula in Aquarius which was a pale blue with a white nucleus and with "interior arrangements" which were "evidently extremely intricate." She goes on:

"A strikingly similar object is situated in the constellation Andromeda. Imperfectly seen at first as a uniform, greenish blue disc, an interior vacuity detected at Parsonstown betrayed its true nature to be rather annular than simply planetary. Nor is the ring it includes by any means symmetrically shaped. Lassell considered it to be bi-annular. Professor Vogel was impressed with the warped and twisted aspect of what may conceivably prove to be a multiple combination of rings thrown off in various planes. Closely wound spiral branches, and a central star were observed with the Ross reflector.

DR. SCHEINER'S PHOTOGRAPHS

"The photographic study of these two nebula/ lately set on foot by Dr. Schemer at Potsdam, may be expected to add much and rapidly to our knowledge of their nature and conformation. The images obtained of them, although only half a millemetre in diameter, show a considerable amount of detail. They confirm the annular shape attributed to them on the warrant of telescopic observations, and bring out, with singular strength the central nuclei which the best telescopes have not always availed to display. In the photographs these are, nevertheless, the brightest parts of each conformation. Yet they are mere irregular condensations with no pretentions to a stellar nature. The superiority of their actinic power repeats the phenomenon first brought into notice by photographs of the Lyra nebula, and seems to point to a general law. Dr. Schemer thinks it can only be accounted for by supposing a predominant quantity of some peculiar gas emitting, in the main a highly refrangible light, to be collected in the central regions of planetary nebulæ, yet the resulting nuclei, when they can be seen at all, shine with a white light, bear a star-like aspect, and probably give continuous spectra. The problem of their real constitution is thus far from easy to solve. But whatever the secret of their photographic effectiveness, it is already tolerably evident that they, play a part of fundamental importance in primary seats of the forces by which these interesting objects are moulded into characteristic shapes . . ".

A PROPHETIC SENTENCE

There is something prophetic about the last sentence quoted. Coming as it does after the remarks upon the light emitting powers of the nuclei--a suggestion, it will be noticed, that they may be small suns, certainly lurks in

those remarks about the action of the nucleus on the camera plate--coming after those remarks, that last sentence, although its author does not seem to recognize it, plainly hints at the planetary and annular nebula as systems in which a central sun not only illuminates but controls (the "primary seats of the forces," etc.) the outer rings or discs--that is, holds them by gravity.

CONCERNING PLANETARY NEBULAE

But before pursuing this further we may as well obtain more evidence--for there is plenty of it. Miss Clerke, in an article in the *Scientific American Supplement*, Vol. LVIII, page 24122, remarks that in all planetary nebulæ the nuclear star "appears to act as the pivot of the surrounding vaporous structure." But she admits that "the question, however, is still open as to the real nature of the connection between the planetaries and their central star." She mentions a theory that the central star is "fed" by the outer nebula, but she admits that there are not enough facts to back it up. She discusses the centripetal tendency which would cause the central star in every case gradually to attract and incorporate the larger outside shell, but she reminds us that repulsive forces are active in such systems as well as concentrative ones, and she admits that as far as orthodox astronomy is concerned the riddles of nebula formation are not solved.

EARLY OBSERVATIONS OF NEBULAE

It is interesting to note that the central star, although its observation has been made much more detailed by photographic methods, was clearly seen by the earliest investigators. According to Professor C. A. Chant, writing in the Scientific American Supplement, Vol. LXXV, page 88, Simon Marius made the first of such observations in 1612, two years after Galileo had invented the telescope. Marius' description of the nebular nucleus is very suggestive; he compares it to "the flame of a candle seen through a transparent horn." Many years later Hershel observing this same nebula--it is the Great Nebula in the Constellation of Andromeda--notices that the central point "though very much brighter than the rest, is decidedly not a star."

NUMBER OF NEBULÆ IN THE VISIBLE HEAVENS

Russell Sullivan, writing in the *Scientific American Supplement*, Vol. LXXIX, page 287, on the planetary nebulæ, remarks that their number is very small compared with the spirals, the known ones being counted by the score, while it has been calculated that there are over 500,000 nebulæ in the heavens as we know them. He notes that there is "often" a central star or haze,--really always, as we have seen--so that the nebula is not, as Herschell had supposed, a mere hollow sphere. It is, however, hollow, often presenting an elliptical appearance.

THE SHELL-LIKE STRUCTURE AND THE CENTRAL STAR

That the typical nebula has a remarkable shell-like structure and a central star--which together form the basis of the evolution of every planet according to our theory--is well brought out in a remarkable series of observations described by Dr. Heber D. Curtis of the Astronomical Society of the Pacific, briefly reported in the *Scientific American* of October 14, 1916. The report follows:

"Fifty of these nebulæ have been studied photographically with the Crosly reflector, using different lengths of exposure in order to bring out the structural details of the bright central portions as well as of the fainter, outlying parts. Most planetary nebulæ show a more or less regular ring or shell structure generally with a central star."

A paper by Messrs. Campbel and More presented at the same meeting gave the results of a search made with a spectrograph and the Lick 36-inch telescope for rotation effects in 33 planetary nebulæ. Definite evidence of rotation was found in 16 and suspected in five others.

CONDENSATION AND ROTATION

There it will be seen are evidences of all the phenomena which we claim are associated with the beginnings of planets, a separation of the nebulous mass into a central star or sun and an outer envelope whose inner walls are probably repelled in some degree at least by the light from the central star--as light has been proved to exert a small but definite pressure--and the rotation

of the whole affair which causes it to take the form which later condenses into the planets as we know them. It may also be noted here that in planetary nebula a greenish color is always noticeable showing that condensation has preceded further than the purely incandescent stage.

But the orthodox astronomer pays less attention to the shell-like nebula than he does to the spiral, and as we have seen, Chamberlin would derive the evolution of our solar system from a spiral nebula. Professor T. J. J. See writes about this in the *Scientific American Supplement*, Vol. LXIII, page 26,008. He points out that we have no proof as yet that the nebula do form stars or systems of stars. (Our sun is a star; the earth is not) He says that speculation on the spiral nebula has gone wild and that it is time to call a halt.

"There is not the slightest probability that our solar system was ever part of a spiral nebula, and such a suggestion is simply misleading and mischievous. The great circularity of the planetary orbits shows the absurdity of such a hypothesis, and this leading characteristic of our system as bearing on its mode of origin was carefully considered by Leplace more than a century ago.

"At present we must frankly admit that the nature of the spiral nebula is quite unknown. And while we cannot be sure that nebulæ develop into stars we may justly hold that the stars are outgrowths of gravitational condensation of matter which was once dark."

In other words, whatever spiral nebula developed into, according to See they do not develop into stars or suns. We doubt, he says, "whether the forms of the nebulæ can be expected to disclose the processes of stellar evolution."

But there is certainly evolution going on in them. If it be not the evolution of suns or stars, may it not be the evolution of planets?

SERVISS ON LAPLACE

But if the reader wishes more detailed criticism of the idea so opposed by See, let him turn to Garrett P. Serviss'"Curiosities of the Sky". Mr. Serviss points out that it is much easier to criticize Laplace's theory of nebular evolution than it is to replace it. He pictures the great whirling nebula observed by Lord Rosse with its striking "appearance of violent whirling

motion," and its apparent tearing up by centrifugal force--which is apparent only, as further observation shows that the masses apart from the center are not being hurled off but have definite orbits. There is there, says Serviss, no confirmation of the Laplacean hypothesis, but, he asks, "What hypothesis will fit the facts?"

OUR ANSWER TO THIS CHALLENGE

Let us endeavor to answer him.

The foregoing observations may have seemed to the reader who is unacquainted with astronomy to be tedious and to lead nowhither. But they have been necessary and we will now proceed to draw the threads together. What have we really discovered? We have discovered, in the first place that there are large gaseous bodies in the sky with glowing nuclei and shell-like or spiral outer boundaries, and that in some way planets come from these. But neither Laplace's theory or Chamberlin's theory of how this evolution comes about fits the facts. We have read admissions from more than one astronomer that the facts they observe cannot be fitted into any coherent theory of planetary evolution. We have adduced abundant evidence from the best sources that any one force, centrifugal or otherwise, cannot account for what we see.

WHAT WE ACTUALLY SEE GOING ON

Now what is it that we actually do see? In the first place a very large number of spiral nebular; in the second place a much smaller number of nebulæ which look either annular or planetary shaped to the eye, but which Sir Robert Ball tells us, in the quotation given before, are related and tend to have a shell-like circumference and always have a central nucleus which is not a star. We remember also the quotation from the *Scientific American* in which Dr. Heber Curtis told the Astronomical Society of the Pacific that recent observations of planetary nebulæ showed them to have a shell-like structure and a central nucleus. Now there is no way of telling by looking at these nebulæ which are the oldest, the spirals or the shells. To tell that, we have to make an inference, but it is a very obvious one. Evolution is always from the relatively unorganized and chaotic to the relatively organized and

orderly. Obviously, if there is any evolution at all, it must be from the wildly whirling, chaotic spiral nebulæ to the shell form with its relatively stable exterior and its nucleus within. In other words the spiral nebula is the first stage; the shell-like nebula is the second. What is the third?

MOULTON AND CHAMBERLIN'S THEORIES

The usual answer is: a solar system. But Moulton has shown the impossibility of this in his criticism of the Laplacean theory. The reader will remember that, among other things, he argued that all the lighter elements such as hydrogen would fly off first and be present only in the outer planets of the so-evolved solar system, while we know that that has not been the case in our own--there is hydrogen on earth and even in the sun. And Chamberlin's theory on the other hand can only successfully deal with the spiral nebulæ; it ignores the evolution of the spiral into a shell-like nebula; to say nothing of the fact that Serviss in the book already referred to in this chapter, criticised that theory in a number of details. The Laplacean theory, he says, is infinitely simpler, "and with proper modifications could probably be made more consonant with existing facts in our solar system than that which is offered to replace it. Even as an explanation of the spiral nebulæ, not as solar systems in process of formation, but as the birth-places of stellar clusters, the Planetesimal Hypothesis would be open to many objections. Granting its assumptions, it has undoubtedly a strong mathematical framework, but the trouble is not with the mathematics but with the assumptions. . . . . "

WHY NOT A PLANET?

But supposing the final stage in the evolution of a nebula is not a sun or a solar system but a single planet? We should then be able to explain the evolution of the nebula satisfactorily but we should have to revise our notion of the structure of the typical planet. But that is precisely what we are willing to do, because we have all sorts of evidence, in varying fields, that the actual structure of the earth, Mars, and Venus,--and hence, we may assume of every planet throughout the stellar universe, is just what we should expect from the period of their evolution that is open to our discovery in the observation of the nebulæ.

OUR THEORY OF THE EVOLUTION OF THE NEBULA

In short, we hold that the shell-like structure so well described by Sir Robert Ball, grows more and more definite as the nebula cools, until it solidifies. We hold that the central sun which holds it by gravitational contraction in its spherical circumference also cools and contracts but keeps its relative position. And we further hold that the black apertures which Ball also describes (and pictures) as characterizing the Dumb-bell Nebula are typical of the two openings which are always left when the nebula cools into a planet. Owing to the fact that the planets are not spherical but are oblate spheroids, that is to say having their greatest circumference at the equator, and owing, too, to such force-factors as the varying centrifugal force due to the unequal sphericity of the orb and the oscillation of the outer envelope around its axis, the two polar openings which are so distinctly shown in the Dumb-bell nebula are gradually formed.

REFERRING TO THE DUMB-BELL NEBULA

If the reader refer to any book on astronomy preferably Ball's--which contains a picture of this nebula he will readily see how this occurs. The nebula is so called because the two larger polar openings form two scooped-out spaces in what would otherwise be a spherical, or more exactly spheroidal body. Imagine an apple with two very large bites taken out of opposite sides, the center of each bite being one end of a diameter, and you have a very clear representation of this particular nebula. But why, the reader may ask, should this particular shaping take place rather than any other. Why should this whirling motion and differentiation of parts end in the formation of planets with two polar openings, one at each terminus of the axis of rotation? The answer is simple. We know that the earth is not a spherical body but an oblate spheroid, that is to say it is a body whose equatorial diameter is greater than its polar diameter; in other words, the polar axis is shorter--the poles are flattened. This is the case in all planets we can observe with the telescope. That it would naturally be the case follows from the nature of the centrifugal force. If a spindle is revolved very rapidly, and water thrown upon it, the water is hurled away again, in a direction away from the spindle, at right angles to its axis of rotation. Now, in the case of the nebula that became the earth--or we can substitute the case of any other planet--we have the force of

gravity holding the whole envelope of the nebula in a clustered mass around the central nucleus; we have the centrifugal force throwing it off in an envelope and always tending to throw off the outer portions of it away from its axis of rotation and more toward the equator than toward the poles--for that is the direction in which the centrifugal force acts--so that the equatorial diameter would be established as soon as the centrifugal force and the gravitational force balanced, and the attraction of the greater mass of the envelope for the very thin part of the envelope at the poles would cause the opening gradually to define itself. As soon as the very thin vapor at the actual poles was attracted a little toward the equator it would come within the play of the centrifugal force and would then also be pushed out a little so that the lips of the polar opening would gradually be defined, as indeed, in the Dumb-bell nebula we see them gradually getting defined. Then, as the mass liquefied and ultimately hardened, the inner sun would also have shrunk, and the light that once shone through the outer envelope would now be illuminating its inner side and only escaping through the polar openings. And from that point the evolution of the surface of the planet goes on in the way that has so often been described, with constant upheavals at first, with the separation of land and water after the planet has cooled to the point where water can form, and who can doubt that some similar sort of evolution has gone on in the inside and hidden portion of the planet?

DETAILED PROOFS WILL FOLLOW

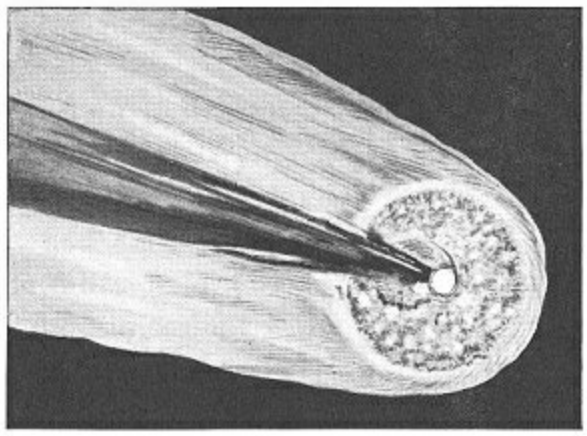
The reader who is astonished at the idea of such an evolution as this must remember that in the succeeding pages we shall give detailed proofs from the observations of such near planets as Mars, Mercury and Venus, and from explorations of the earth itself to support this theory. But before considering the planets let us here consider another body met with in the heavens--the comet.

THE COMET EXPLAINED

Our theory explains the comet, and the comet agrees with the other celestial bodies in illustrating our theory. A comet is a body, coming from outer space across our skies, with a relatively small solid or fused head, and with an enormous gaseous tail streaming behind. Whether some travel in

orbits which are not closed curves and so will never bring them back to our sky--or whether they do have extremely eccentric but closed orbits is a mooted question. Many of them, however, do return, but it is known that when the comet approaches the head contracts and a nucleus is clearly seen, a nucleus which alone is solid or fused while all the rest of the comet is gaseous.

The mystery of the comet lies in its tail. Serviss quotes Herschell as declaring that a profound secret lay there. But if we suppose that the nucleus of a comet is the same as the nucleus of a planet, does it not follow that the tail of exceedingly imponderable and scattered matter is the remains of what had once been an outer shell. In other words a comet is a planet which has died. Either through coming into the orbit of some immensely greater planet or into that of a sun, it has been torn from its own orbit, brought into an area of contending forces, possibly even has collided with another planet, had its outer shell broken up and sublimated by the great heat into the most tenuous sort of a gas which trails after the nucleus which was once central but which now heads the strange celestial procession of matter that we call a comet.



Nothing could more strikingly support our theory than the above illustration. It is taken from a drawing of Donati's Comet, as seen from Cambridge Observatory on October 1st, 1853. The central nucleus is very plainly seen, surrounded by a sphere of glowing gases, and enclosed by an outer envelope. The comet is passing through an area of conflicting forces, and this, and perhaps the excessive heat of the body has caused the great split which extends through the envelope to the central sun itself. A comet is simply a planet which is disintegrating, and this photograph shows us the

disintegration taking place, and just far enough advanced so that we can see the inner structure of the planet. And that structure is precisely what our theory says is the actual structure of all planets, our earth included. As the reader continues in this book let him bear this picture in mind, and he will be more and more struck by the happy manner in which the theory is verified by the structure here shown. And let him remember that this picture was not made up to support our theory, for it was made many years before our theory was promulgated.

MOULTON ON COMETS

How closely this view fits may be seen from Moulton's "Descriptive Astronomy" in which he tells us that while the head with its "small bright nucleus" measures from ten thousand to a million miles and the tail may stream away 100,000,000 miles, the actual nucleus itself only measures a few hundred miles in diameter, varying "in an irregular fashion". But that is precisely what we should expect if the nucleus had once been an interior sun, for a few hundred miles or to the most a few thousand would be just the dimensions which we should expect the interior suns to have varying, of course, with the size of the planets. And here is still more remarkable testimony. Hector MacPherson tells us in his book, "The Romance of Modern Astronomy" that the great comet of 1811, with a tail stretching for a hundred million miles behind and fifteen million miles in breadth, had a nucleus that according to measurements by Herschell was only 428 miles in diameter. The comet of Donati, detected from a Florence observatory in 1858, had a nucleus which "shone with a brilliance equal to that of the Polar Star" and which was 630 miles in diameter. MacPherson also tells us how comets tend to break up into showers of meteors. They are "not lasting" bodies but "even in the short period of man's life comets have been seen to break up and disappear". Surely that fact coupled with the size of the average nucleus shows us that a comet is in very truth the last state of a planet after it had been broken up, and before its last vestige--the central sun--in its turn is broken into fragments.

CELLULAR STRUCTURE THROUGHOUT THE UNIVERSE

It is perhaps aside from our main argument, but the likeness between the

cellular structure of the living body, the cellular structure of the atom, which is now thought to be a highly complex thing, and the supposed cellular structure of the heavenly bodies has not hitherto been pointed out. But only if our theory be true are the heavens really filled with cellular bodies. If our theory be true, the planet is seen to be a body very like the protoplasmic sell of the living animal or plant, which has its outer envelope and its central nucleus. And we must remember too, that the atom, as modern science views it, is a system of tiny particles which form a sort of envelope around a pivotal point. At all events the analogy is a striking one although we do not wish to push it too far or to deduce anything from it. After all, there is so much direct evidence from every angle to support this theory that we can afford to leave severely alone all mere reasoning from analogy and fantastic comparison.

CHAPTER III. MARS

If the theory as outlined were correct it ought to be possible to make it more and more probable and at last prove it without a shadow of a doubt by making closer and closer observations. We have made it sound plausible by examining celestial bodies which are very far off--the nebulæ. Let us now proceed to make it sound much more reasonable--perhaps we may even be able to prove it absolutely by applying it to the observation of a body that is much nearer us--and therefore susceptible of much closer observation--than the nebulæ, and that is the planet Mars. When we bring the telescope to bear on Mars, the planet, especially its polar regions, is brought so near that Percival Lowell has even remarked that we know more of the Martian polar regions than we have hitherto known about our own earthly ones. We shall observe Mars in detail then, following our observations with a brief glance at Venus so that we may check up on what Mars shows us. Then we shall take the final step that proves our theory up to the hilt.

FROM MARS TO EARTH

For there is a planet that we may inspect with even greater detail than we can inspect Mars--and that is our own. With the knowledge gained from inspecting Mars we can read the answers to certain riddles of Polar exploration that have hitherto baffled both the scientists and the explorers who found the scientists' theories inadequate to guide them when they actually reached polar regions. We shall then have traversed the solar universe from the farthest nebula to the very ground under our own feet. If in that survey we find no facts that contradict our theory but numbers of facts which contradict every other theory; if those facts all line up and fit into our theory and ours alone; we shall rest satisfied that we have actually discovered the true structure of the bodies which revolve in space. And, knowing the structure of our earth truly for the first time, it is but a step to utilize our knowledge in ways undreamed of hitherto--but that is to anticipate.

A GENERAL SURVEY OF MARS

Let us first attain a general idea of the planet Mars as it is revealed to us by the telescope and explained by the orthodox astronomers. For this Moulton is as good a guide as anyone. In his "Introduction to Astronomy" he gives all the necessary elementary knowledge of the planet. Its orbit is the next beyond that of the earth--the sun being the center, while the orbit of Venus is nearest to the earth on the inner side. Its mass and volume are considerably less than the earth--and it is this relative closeness to the earth in position that has made Mars so favorite a location for those people who speculate on the possibility of life on other planets. For they argue that conditions on Mars should be very similar to conditions on the earth. Mars has two small satellites, much smaller and nearer than our moon, and the period of the rotation of the planet is about thirty-eight minutes longer than our own day of twenty-four hours. An-other similarity with the earth is that the inclination of the plane of the equator to the orbit of Mars is about 24 degrees, so that its days and seasons would be very much like those of the earth.

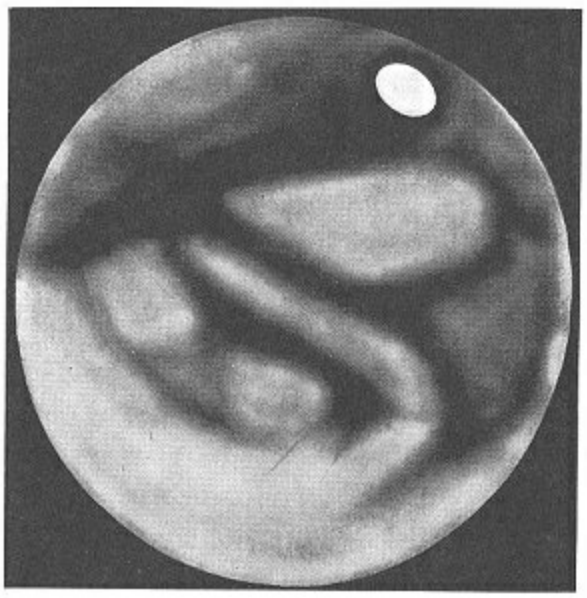
THE ATMOSPHERE OF MARS

Fortunately for the astronomer who wishes to observe its surface Mars has very little atmosphere. The amount of atmosphere is calculated by noticing--through the aid of proper apparatus and calculations--the amount of light received by the planet and the amount reflected from it. The ratio between those two is called the albedo. Clouds reflect more light than earth surfaces do for the light is absorbed by the atmosphere in part before it reaches the surface and the light reflected from the surface is again subject to tribute by atmospheric absorption before it gets clear from the planet and so the small amount of light reflected from the surface of Mars shows us that it has but little atmosphere. Other observations support this the fact, for instance, that when a star is hidden or "occulted" by Mars there is no gradual hiding due to a rare and then denser atmosphere intervening as the paths of Mars and the star cross, but a sudden blotting out of the star. We lay stress on this point here, for it is in apparent contradiction to the phenomena of the light from the polar caps of Mars--which the older astronomers thought were ice caps reflecting light through what must have been an atmosphere as the light certainly rose above the surface of the planet.

THE CIRCULAR POLAR CAPS

In appearance Mars is a reddish planet to the naked eye, but the telescope reveals a surface of variegated color. There are many dark patches in the surface and they are fixed--but at each pole is a large circular white cap which at its apparent maximum extends from 25 to 35 degrees from the pole and which diminishes in size in the spring season until it sometimes disappears totally. But the reader should not jump to the conclusion that that diminishing in spring indicates that the cap is composed of snow or ice. The astronomers themselves have begun to doubt that. For the cap does not diminish gradually as it would if it were gradually melting ice. It does it by sudden jumps--but we shall return to that in detail later on.

Moulton notes these facts, remarks that some of the appearances of the caps are such as to indicate View of Mars, showing the circular white spot which is an entrance to this planet's interior, instead of the so-called polar ice cap, thus proving that Mars, the earth, and all other planetary bodies are hollow and contain a central sun. (Photographed by F. A. A. Talbott, Beighton, England.) For optical reasons all astronomical photographs are inverted. that they might be snow, but he immediately adds that we cannot account for the warm climate that would be necessary to cause the melting of the caps if they really were of snow.



THE CANALS

The next thing we notice on the surface of the planet is the so-called system of canals. These were first seen in 1877 by Schiaparelli who called them by the Italian word "canali" which meant not canals but channels. As they are from twenty to sixty miles wide it is obvious that the later English designation of canals is a little unfortunate, even though Professor Lowell thinks that they are artificial constructions. These channels extend along the arcs of immense circles, and measure in length from a few hundred up to four thousand miles. Often they intersect in dark so called "water-areas" or "lakes". Lowell claims that the junctions of the canals are always supplied with lakes and that there are no lakes except at the junctions of canals. In 1882 Schiaparelli discovered that many of the canals were double, two running parallel to each other at a distance apart of 200 to 400 miles. Later observations confirm this although the apparent doubling was found to depend on the season. But what the canals mean Moulton does not know. They may, he says, be due to some kind of vegetation, they may be due to optical illusion. "The doctors disagree," Moulton admits. That the planet's outside surface is the abode of life, as held by Professor Lowell, has been questioned on the ground that it would be too cold to support life. But Moulton doubts if the planet is as cold as the application to its supposed conditions of certain mathematical formulæ would indicate. And how uncertain the scientists are on this point may be seen from the fact that some of them have thought the polar caps are of snow while others have thought they consisted of frozen carbon dioxide gas which only solidifies at 109 degrees Fahrenheit.

NO ADVANCE IN KNOWLEDGE OF THE PLANET

In his "Descriptive Astronomy" written six years later than the book we have just been referring to, in 1912, Moulton has no advance to record in knowledge of the planet. Again he points out that the small amount of water on the planet would render the polar ice cap theory untenable. And if there were water, he adds, it is not at all certain that it would be raised in clouds, transferred from one region to another, and precipitated as snow. Mars only receives from the sun less than half the amount of light and heat that the earth does, and so its temperature is much less than that at which snow would

alternately form and melt, and to the suggestion that it is frozen carbon-dioxide that forms the polar cap, Mr. Moulton opposed the fact that carbon-dioxide in an atmosphere, by its absorptive power, tends to produce a high mean temperature, and so would prevent any such phenomenon as the freezing of a gas at the poles. And so Moulton concludes:

"At the present time we are not, justified in drawing any positive conclusion about the meaning of the polar cap or the climatic condition of Mars."

SOME NEW FACTS

Such is the general impression of Mars and our knowledge about it that is gained from elementary text-hooks and that was once held by all astronomers. But there are some curious facts that do not seem to have been noted by Moulton before he wrote these two books or if noted they did not seem to him to be important--and these facts are at once very important and easily explained in the light of the present theory. Let us, therefore, see what those writers have to say who deal more in detail with this one planet.

E. Walter Maunder, F. R. A. S., in his little book, "Are the Planets Inhabited?" goes into some details regarding the presence of water on the planet. He puts the question whether the so-called canals are artificial or natural formations. If they are artificial it would certainly seem as if some intelligent inhabitants had made them for a purpose, and as they wax and wane with the seasons it would seem as if Lowell were right when he claimed that what we saw when they waxed in the spring was the mass of vegetation growing by means of their irrigation, while the drying up of the vegetation in the winter would signalize the fact that the water supply had given out. On the other hand if we found them to be not artificially created canals at all, then Lowell's theory of the utilization of water from the poles would be invalidated, and we would be left just where Moulton's two books left us--in sheer ignorance of the whole matter.

But Mr. Maunder has a lot to urge against Professor Lowell's theory. Mars, he tells us, is much more like the moon in its conditions than it is like the earth. After studying in detail the temperature of Mars, Mr. Maunder concludes:

"The size of Mars taught us that we have in it a planet with an atmosphere of but one half the density of that prevailing on the top of our highest mountain; the distance of Mars from the sun showed us that it may have a mean temperature close to that of freezing mercury. What chance would there be for life on a world the average condition of which would correspond to that of a terrestrial mountain top, ten miles high and in the heart of the polar regions? But Mars, in the telescope, does not look like a cold planet. As we look at it and note its bright color, the small extent of the white caps presumed to be snow, and the high latitudes in which the dark markings--presumed to be water or vegetation--are seen, it seems difficult to suppose that the mean temperature is lower than that of the earth.

In the summer, the white polar caps of Mars diminish to a far greater extent than the snow and ice caps of the Earth; indeed, one of the Martian caps has been known to disappear completely.

GREAT EXTREMES OF TEMPERATURE

The contradiction between this calculated very low mean temperature and the observations he has just made, Mr. Maunder finds in the fact that the extremes of temperature are very great on Mars. The maximum temperature of the planet, he thinks, is above the freezing point of water, but normally the water on the planet is frozen: "Mars is essentially a frozen planet; and the extremes of cold experienced there, not only every year but every night, far transcend the bitterest extremes of our own polar regions."

For that reason, he says, it is very unlikely that there is any vegetation on Mars, except possibly some of the very lowest type. But here is a very interesting point regarding the patches that have been thought to be water:

"Some of the so-called seas may possibly be of the latter class (stretches of vegetation) but that there must be expanses of water on the planet is clear, for if there were no water surfaces there would be no evaporation; and if there were no evaporation, from whence would come the supply of moisture that builds up the winter pole cap?"

"But we thought astronomers had given up the idea that the polar caps could be proved to be of snow," the reader may exclaim.

ASTRONOMERS ARE CONFUSED

Well, the quotation just given shows the confusion on the subject in the minds of the orthodox astronomers. For right after saying that, Mr. Maunder quotes Professor Newcomb as remarking:

"There is no evidence that snow like ours ever formed around the poles of Mars. It does not seem possible that any considerable fall of such snow could take place, nor is there any necessity of supposing actual snow or ice to account for the white caps."

But Professor Newcomb does not go as far as the reader is, perhaps, expecting him to go. For snow he only substitutes a hoar-frost formed of extremely fine particles of water vapor (how, in such a low temperature they came to be vaporized and brought to the pole before re-freezing, he does not say.) And after quoting that, Mr. Maunder himself says, a little later on, that Mars is always a frozen planet, frozen except on its mere surface when this is exposed to the full rays of the sun.

In other words the surface of the planet would be more or less uniformly bright if this were the case. Certainly hoar-frost at the poles would not be such a different surface from all the rest of the planet as to give us the characteristic appearance of the polar caps; and those caps would never disappear by whole-sale bounds as they have been observed to do in actual fact.

No, the astronomers who try to theorize on the basis of polar snow caps are simply getting themselves into logical trouble.

In his book entitled "Mars", Lowell says, in presenting a map of what he thinks is the "ice cap" of the southern Martian pole:

"It will be seen from it how much farther advanced is our knowledge of the Martian south pole and the regions about it than is our knowledge of either of our own."

What a significant admission that is, and not so much out of date at the present time as most people imagine who have taken all their knowledge of our earthly poles at second hand and never examined into it.

An English astronomer, E. S. Grew, in his text book, "The Growth of a Planet," remarks that polar conditions on Earth and on Mars cannot be compared because the meteorological conditions are quite different in the two planets.

But supposing what we see can be explained only by conditions which are not meteorological? Then the two planets, perhaps, can be compared. It is because our theory points to something permanent in the structure of the planet as the explanation of polar phenomena, and not to mere meteorological changes, that we can compare the two planets and show similar agencies at work on each of them, testifying to a structure which is the same in the one as in the other--and as in all others indeed.

But let us turn to an observation of Professor Lowell of the utmost value. On page 86 of his book, "Mars", Professor Lowell records:

"Meanwhile an interesting phenomenon occurred in the cap on June 7 (this was in 1894). On that morning at about a quarter to six (or, more precisely, on June 8, 1 hour, 17 minutes, G. M. T.), as I was watching the planet, I saw suddenly two points like stars flash out in the midst of the polar cap. Dazzlingly bright upon the duller white background of the snow, these stars shone for a few moments and then slowly disappeared. The seeing at the time was very good. It is at once evident that the other-world apparitions were--not the fabled signal lights of the Martian folk, but the glint of ice-slopes flashing for a moment earthward as the rotation of the planet turned the slope to the proper angle. . . . But though no intelligence lay behind the action of these lights they were none the less startling for being Nature's own flash-lights across one hundred million miles of space."

These star-like points had, however, been seen before, and Lowell goes on to check up his observations with those of others:

"Calculation showed the position of the star points to be in longitude 280 degrees and 290 degrees, and in latitude 76 degrees south. At this place on the planet then there was a range of slopes sufficiently tilted to reflect the sun from their ice-clad sides. On comparing its position with Green's map of his observations upon the cape of (Madeira) in 1877, it appeared that this was the identical position of the spot where he had seen star-points then, and where Mitchell had seen them in 1846, to whom they had suggested the same

conclusion. Green Christened them the 'Mitchell Mountains.' At the time both these observers saw them, they were detached from the rest of the cap. We shall see that they eventually became islands, just as Green saw them, and that the observation in June marked an earlier stage in their history."

Now it is important to note in the above exactly what was seen--far more important, to do that than to pass it over and listen to Lowell's ideas, merely, about what he saw. And the definite thing that Lowell plainly saw, and was astonished by, and specifically mentioned, was "two points like stars flash out in the midst of the polar cap."

And let us also note that Green saw, many years earlier, two spots and that Mitchell saw, as far back as 1846, something similar but with a difference--which we shall come to presently. But meanwhile let us see how inadequate is Professor Lowell's explanation of what he saw--so that we may keep distinct the actual thing and the mere theory which was made up to account for it.

In the first place, Edward S. Morse, in his "Mars and Its Mystery", a book which warmly supports Lowell's theories about life on Mars, on page 138, tells of photographs taken by Professor Pickering of the polar regions of Mars in which a vast area of white appeared around the pole in the amazingly short space of twenty four hours. In that time an area nearly as large as the United States was visible as a white cap, and then it gradually disappeared.

And yet Professor Lowell asks us to believe--if this is really ice at the poles that it is so permanent that two very steep slopes--so steep as to reflect light direct to Earth--should keep their size and shape and positions from 1846, when Mitchell saw them, until the present day. And we remember, also, Professor Newcomb's explanation that there is no snow or ice at the Martian poles but only immensely fine hoar frost which could not possibly pile up into steep cliffs and reflect light to us in the way described. And even Professor Lowell himself, in his other book, "Mars as the Abode of Life," admits that it would be very hard to prove that the polar caps were composed of snow or hoar-frost, and that he could not have--to his satisfaction proved it if it had not been that around the polar area was to be seen a band of dark blue which he took to be water from the melting ice of the snow-cap (page 81). But later on in the same book he speaks (page 140) of the well-known

total disappearance of the one cap and the almost entire extinction of the other, showing how each summer melts what the winter had deposited, and that in both cases that is nearly the sum total of the cap.

But if both caps are thus depleted by each summer, how could a great ice cliff--again we ask the same question--remain since 1846 to reflect to us the light that Lowell saw?

No, there are too many contradictions there. Ice cliffs, if they formed in the polar regions of Mars, would form at so many different angles and in so many different relative positions that flashes would be constantly sent over to us: There would be a display as continuous as that of heliograph signaling. As a matter of fact, what Lowell really did see was a direct beam two direct beams at the same moment flashing from the central sun of Mars out through the aperture of the Martian pole does not the blue rim around that area to which Lowell has referred indicate the optical appearance of the reflecting surface of the planet gradually curving over to the interior so that at a certain part of the curve it begins to cease reflecting the light?--and the fact that it is not seen often simply shows that it is only when Mars is in a certain position with relation to the earth that we are able to penetrate the mouth of the polar opening and catch the direct beam.

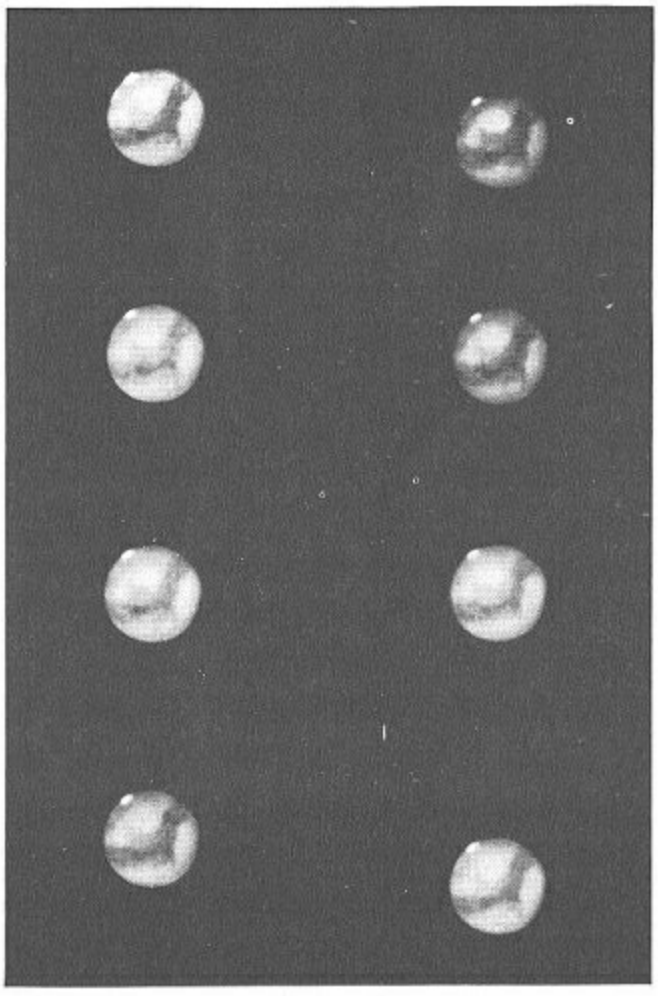
BEAM OF LIGHT WAS YELLOW

That it was a direct beam of light that Lowell saw, and not mere reflection may easily be proved. He particularly said, in writing about his discovery, that the light from the Martian cap was yellow when it was viewed at night. What does that imply?

The reader can best answer after making a simple observation. Let him go out any night and look into a lighted window from a distance. The flood of light coming from the window will be yellow. The reader will also find that all artists paint lighted windows seen through the night as being yellow. We may go close up to the window and see that the source of the light is an incandescent electric light bulb which may be dazzlingly white and yet the light at a little distance is just as yellow as if the window were illuminated with yellow-flamed candles.

Also the reader may try something else. Let him, after looking at the window from a short distance, as we have suggested, move away to one side, so that he no longer looks directly into the window, but sees it from a very great angle. The light from the window will then be seen to extend out beyond the window to a certain extent.

We may now apply this to Mars. It proves that the light from the polar region of Mars is a direct Views of Mars taken at the Yerkes observatory, Sept. 28, 1902, showing the white circle or so-called snow-cap, projected beyond the planet's surface, which precludes all possibility of its being snow or ice. illuminant from within the planet, because that light, seen at night, is yellow. Any other sort of light, a reflection from a snowy surface, for instance, or a reflection from sand or mountain surfaces, would be white.



And if the reader will refer to our photograph of Mars on page 80 he will

notice that the light from the polar openings extends in a spreading mist of luminosity of a very definite form which cannot be mistaken and which is obviously many miles above the surface of the planet. Now let the reader compare that with what he saw when he looked through the night at a lighted window at an angle it is the same sort of extension of light. So that again proves that the Martian light is coming from a direct source and illuminating the section of the Martian atmosphere just above the polar opening.

BRILLIANT LIGHT FROM POLAR CAPS

Mitchell, whom Lowell quotes in the above extract, has some very interesting points to make. He speaks of the brilliant light of the polar caps a light more brilliant than that of the other surfaces which are supposed to be covered with ice. Then comes his description of the beam of light which we hold to come direct from the central sun of Mars:

"On the evening of the 30th of August (1845), I observed, for the first time, a small bright spot, nearly or quite round, projecting out of the lower side of the polar spot. In the early part of the evening the small bright spot seemed to be partly buried in, the large one. . . . . After the lapse of an hour or more, my attention was again directed to the planet, when I was astonished to find a manifest change in the position of the small bright spot. . . . . In the course of a few days the small spot gradually faded from the sight and was not seen at any subsequent observation."

COMPARING THESE OBSERVATIONS

It will be noticed that Lowell speaks as if what he saw was the same gleam and glint that Green saw, and the same thing that Mitchell saw. But if it were really a permanent ice-cliff, why did Lowell and Green see the two flashes and Mitchell one flash? And why did something so permanent that both Green and Lowell saw it many years apart, why did it prove so impermanent when Mitchell saw it? Why was it only one gleam then, and not two, and why did it fade away?

A GLEAM FROM CENTRAL SUN OF MARS

Obviously it was a gleam from the central sun of Mars that Mitchell saw, and the reason it faded was because cloudy weather gradually obscured the interior atmosphere of Mars. And when Green and Lowell saw it a small cloud had passed over the face of the interior sun and that broke the gleam into two projecting beams with this opacity between them, so that to Lowell two separated parts of the area of the Martian sun were visible and each sent its rays of light direct into his telescope.

OBSERVATIONS VERSUS EXPLANATIONS

It is very interesting to read Lowell's account of these observations and to note how his observations all fit into one another and are accurate and how his explanations fail to account really for what he sees. In this same part of his book, "Mars", he speaks of a fellow observer, Mr. Douglass, who detected "rifts" in the cap--which sounds suspiciously as if this observer has seen clouds in the interior of the planet passing across the face of the polar opening. And Lowell adds, "On June 13 I noticed that behind the bright points the snow (he calls it) fell off shaded to this rift" which again sounds as if clouds were gathering near the bright spots. He continues:

"Bright spots continued to be seen at various points to the westward round the cap. . . . . Throughout these days the cap was wont to appear shaded on the terminator side."

The last sentence surely suggests that cloud formations were coming into the field of view and that wherever they thinned the bright spots from the central sun could be seen between them.

We may note, in passing, that Proctor, the English astronomer, also refers, in his "Other Worlds than Ours," to the brightness of the polar regions although he does not have the correct explanation of it.

That more attention should be paid to this brightness of the polar regions of Mars, is emphasized by an English astronomer, W. E. Denning, who contributed to the English scientific periodical, Nature, an article on the physical appearance of the planet from observations made in 1886. He says:

"During the past few months the north polar cap of Mars has been very bright, sometimes offering a startling contrast to those regions of the surface

more feebly reflective. . . These luminous regions of Mars require at least as much careful investigation as the darker parts, for it is probably in connection with them that physical changes (if at present operating on the planet's surface) may be definitely observed. In many previous drawings and descriptions of Mars, sufficient weight has not been accorded to these white spots."

Earlier writers, however, had noticed that the spots were brighter than the other surfaces of Mars, an astronomer, writing in the Scientific American Supplement as early as 1879, in effect, having made that observation. But this writer was not aware of the real nature of the light. In 1892 the celebrated English astronomer, J. Norman Lockyer, repeated in a periodical a number of observations he had made thirty years before and had then communicated to the Royal Astronomical Society of England. Here is a significant quotation:

"The snow-zone was at times so bright that, like the crescent of the young moon, it appeared to project beyond the planet's limb. This effect of irradiation was frequently visible; on one occasion the snow spot was observed to shine like a nebulous star when the planet itself was obscured by clouds, a phenomenon noticed by Messrs. Beer and Madler, recorded in their valuable work, '*Fragments sur les Corps Celestes*.' The brightness, however, seemed to vary very considerably, and at times, especially when the snow zone was near its minimum, it was by no means the prominent object it generally is upon the planet's disc."

A DIRECT SOURCE OF LIGHT

No one who reads the above in the light of our theory can fail to see how it fits into it. A snow cap would not reflect light with so much more vividness than the other surfaces of the planet, and only direct beams of light coming from a central sun could give that luminous effect above the surface of the planet and varying as the atmosphere in the interior or above it was clouded or clear. Had it been a mere ice cap there would not have been this luminosity and, in particular, there would have been no luminosity when the planet was covered with clouds as Lockyer says it was. Furthermore, that luminosity is precisely what our own aurora borealis would look like if our planet was viewed from a great distance. And the light is the same in both cases.

From that early date we jump to 1905 and find Percival Lowell again telling of a bright white "kernel" which he observed at the Southern end of the Martian north polar cap.

That, then, is the situation. All the evidence points to the fact that it is light, and direct light at that, that causes what we have called the Martian ice-caps but which we ought to call the Martian polar openings. But perhaps the reader is still not convinced. He may recall that the writers who treat this aspect of Mars, whether or not they believe in the "canals" seem to have no doubt of the fact that at the poles we have snow or ice. We have already pointed out some inconsistencies in this view. Here are some other considerations that help to dispel that idea, and then, by turning to the planet Venus, we shall demonstrate absolutely that the polar circles are not snow, or ice, or even hoar-frost caps, but simply apertures leading to the inner and illuminated surface of the planet.

WATER VAPOR IN THE ATMOSPHERE OF MARS

A writer, evidently well posted, in the New York Sun, in 1909, summed up the arguments for and against the canal theory and the water-determination theories of Mars, and came to these conclusions:

"If the water vapor in the Martian atmosphere is sufficient in amount to yield an ice cap at the polar bright spots, the tension over the rest of the planet must be such that canals will not be needed because of a sufficient precipitation; if the water vapor content is so slight that the polar caps are nothing but frost, no amount of engineering skill could cope with the tension which would evaporate whatever water may have started in the canals. Under terrestrial conditions these two extremes are well represented by the Hudson which never runs dry, and those rivers of the arid VVest which are greatest at the source and dwindle on their course until they end in a damp spot with bone-dry edges."

By the tension, of course, is meant the proportion of water vapor in the atmosphere which determines, in relation to the temperature, the amount of evaporation that will go on.

THE SPECTRUM OF MARTIAN LIGHT

This same writer goes on to tell how the spectroscope was invoked to solve the problem:

"Fortunately we are not without appliances which may deal with this fundamental problem. The spectroscope yields a record of every sort of light which it dissolves, and the bands corresponding to water vapor have all been plotted on the spectrum. If these hands show at all, it is irrefragable evidence of the presence of water vapor, and in like manner the pronouncement of their definition gives a measure of the amount of such water vapor. If then, comparative observations are made simultaneously of an illuminated object whose water vapor content is well established and of Mars, in which it is yet to establish that factor, the comparison of the bands in the two spectra will give a measure of the results in Mars.

"At the very favorable opposition in September (1909), the whole resource of the Lick Observatory staff was devoted to making this comparison.

"In order to avoid as much as possible of the water vapor content of the earth's atmosphere, greatest in its lowest levels, the observing station was equipped on the summit of Mount Whitney in the Sierras at an elevation of 14,501 feet and in a horizon markedly arid

"For purposes of the astronomical comparison the moon was taken as the standard. A long series of eclipse observations has shown that whatever atmosphere may persist about our satellite is optically indiscernible. Similar series of spectroscopic observations have shown that the water vapor at the moon is wholly inappreciable by the most delicate tests. If the spectrum of Martian light photo-graphed under the same terrestrial conditions shows no more water vapor bands than appear in the photographed spectrum of lunar light the conclusion is warrantable that water vapor on Mars is of such extreme tenuity as not to be made available for cultural purposes.

"The complete results of the Mount Whitney observations have not yet been worked out, but Director Campbell authorizes the preliminary report that the comparison of a simultaneous Martian and lunar spectra proves that Mars has no more water about it than has the moon. He is concerned in the determination of this one fact in physics. The rest follows in its train of inexorable logic. If Mars has no more water than the moon the polar bright areas cannot be ice, snow, or hoar-frost; the most reasonable suggestion is

that they are solidified carbon dioxide, the heaviest constituent of an atmosphere and the longest to linger over a dead world, itself a mantle of death and the shroud of animal life."

POLAR CAPS NOT CARBON-DIOXIDE

Now we are very grateful to this writer for his account of actual observations--in which we heartily concur--but in spite of the eloquence of his closing thoughts--no longer observations, the reader will notice, but mere speculation--we cannot follow him. We fear that his eloquent periods are here wasted, for if the reader remembers what we said a few pages back it is quite impossible that carbon dioxide is the constituent of the poles. For that constituent twinkles, glints, and again is clouded over--it can be nothing else than an aperture giving out light from a central sun and ever and anon clouded over. For whether there is water vapor on the exterior of Mars or not, there is certainly water vapor on the inside. It is this water vapor that causes the interior clouds that have been observed to cut off the light of the interior sun. It is this sun itself that sends those periodical messages--glints of direct light that could never come from an inert mass of frozen carbon-dioxide or from a thin film of hoar-frost that is said to evaporate.

HOW THE ASTRONOMERS ARE MISLED

And let the reader note how this fundamentally false idea of the structure of the planet is misleading the orthodox astronomers all the time. Starting from a wrong basis they naturally attain to wrong results, and so instead of all their theories and observations fitting into one another and leading them nearer and nearer to agreement until they come together in the recognition of the truth, they cannot agree on a single thing. First, they tell us the temperature of Mars is relatively high, then it is so low that carbon dioxide freezes at the poles--in spite of the fact that at certain seasons of the year the poles of Mars are the warmest part of the planet--and then we are told that there is vegetation on the planet and again that there could not be because there is no water and so on in a continual disagreement which widens with the lapse of time and the procession of the arguments instead of decreasing as it would if the astronomers were on the right track.

But if the growing and declining of the alleged polar ice-caps be interpreted as due to a melting and freezing of either water or carbon dioxide, how do those who hold to the idea explain the polar caps of Venus and Mercury?

CORROBORATIVE FACTS FROM VENUS

Let us take Venus first. It is our nearest neighbor on the side nearer the sun, just as Mars is on the side farther from the sun. It is slightly less than the earth in size and has almost the same length of day.

F. W. Henkel, an English astronomer, writing in *The English Mechanic and World of Science,* remarks that:

"When Venus is near the sun, distinct evidence of the existence of an extensive atmosphere, twice as dense as our own, is obtained, and the spectroscope shows the presence of water vapor in some abundance. The dark portion of the planet's disc (that turned away from the sun) is occasionally seen faintly illuminated, (says Professor Young), recalling the aurora and other electrical manifestations on earth."

We shall have a good deal more to say about the aurora later on but for the moment we must let that point pass.

To continue Mr. Henkel's summary:

"The distance of Venus from the sun is only about three-quarters that of the earth, or about 67,000,000 miles, so that any area of its surface must receive about twice the amount of light and heat that an equal area on the earth receives; but as we have already said, the presence of a more extensive atmosphere may to 'a considerable extent mitigate this, to our ideas, excessive amount."

And yet the author of this article immediately goes on to quote Professor Young to the effect that "air, water, lands, continents, mountains, polar snows, etc., all seem to be present."

Polar snows in a sun-drenched planet? That seems curious, and we begin to inquire what other astronomers have to say in the matter.

Not only does H. W. Warren, in his "Recreations in Astronomy," speak of the fact that the tropic zones of Venus extend nearly to the poles--on account of the great inclination of the axis of the planet's rotation--but a later authority, E. Walter Maunder, in his very authoritative book, "Are the Planets Inhabited?", has this to say--after describing the temperatures on the planet--about the climate of Venus:

"Here then is the sufficient explanation why the topography of Venus is concealed. The atmosphere will always be abundantly charged with water-vapor, and an almost unbroken screen of clouds will be spread throughout its upper regions. Such a screen will greatly protect the planet from the full scorching of the sun, and tend to equalize the temperature of day and night, of summer and winter, of equator and poles. The temperature range will be slight, and there will be no wide expanses of polar ice."

POLAR CAPS OF VENUS AND MARS OUGHT TO HAVE SAME EXPLANATION

When we think of that, especially in consideration with the statement that the polar markings of Venus have never been seen to contract and expand at different times, it is obvious that these marks at the poles, in the case of Venus, are nothing less than the apertures through which light streams from a central sun.

But the astronomers, lacking this explanation, are hard put to it to account for what they see. On general principles one would imagine that similar phenomena should always be explained by similar causes. If, for instance, you once see an eclipse of the moon, and its cause is explained to you, you will at once recognize the next time you see an eclipse, that the same cause is at work. You would laugh at anyone who said that one eclipse was caused by the shadow of the earth being thrown on the moon, another eclipse by the flight of a huge body between the earth and the moon, and so on.

Yet the astronomers observing apertures at the poles of Mars explain them in one way when they observe similar apertures at the poles of Venus--they ought to explain those in the same manner. But they cannot do it, for they have postulated frozen water or frozen carbon dioxide as the cause of the polar caps of Mars, and they know there is nothing like that on Venus. So

what do they say? Let Hector MacPherson answer in his book on "The Romance of Modern Astronomy":

"Polar caps", he says, in his chapter on Venus, "have been observed, supposed by some to be some-what similar to those on our own planet and on Mars. Some astronomers, however, do not regard them as snow; the drawings of Schiaparelli represent them as separated by a dark shadow, which suggests that they represent two mighty mountain systems."

MACPHERSON'S EXPLANATION INADEQUATE

Before going on to a very remarkable observation, we may be permitted to criticize this idea in more than one way. In the first place, as we have said, it is absurd to explain one thing--a polar cap or area--by invoking snow in one planet or an open polar sea, and in another planet mountains. Why should mountains on Venus imitate a polar ice cap on Mars, or an ice cap on Mars look like and be placed just like a mountain range on Venus? It is scientific lunacy to argue in any such fashion. And we may be permitted to say also that Mr. MacPherson's language is too vague here. Is he trying to say that each so-called "mountain range" is separated from the surrounding surface of the planet by a shadow, or does he mean that one dark mountain range is separated from the other by a darker shadow--which in that case would lie all over the planet? We hope that nothing said in this book is said in such a manner as will leave the reader in doubt as to which of two possible things we may mean.

But to follow Mr. MacPherson a little further. He quotes a French astronomer, Trouvelet, who in 1878, found the polar spots distinctly visible:

"Their surface," he wrote, "is irregular, and seems like a confused mass of luminous points, separated by comparatively sombre intervening spaces. This surface is undoubtedly very broken, and resembles that of a mountainous district studded with numerous peaks, or our polar regions with numerous ice-needles brilliantly reflecting the sunshine."

Our readers will at once recognize those luminous points for what they are gleams from the central sun. Trouvelet, not knowing this, involves himself in a mass of error in trying to explain what he saw. It is obvious that he

observed the polar aperture during very cloudy weather and the gleams from the central sun were just struggling through the clouds at various points--he saw those and what he took to be sombre mountain masses were really the cloud banks through which the beams were breaking and which, of course, looked very sombre by contrast. It could not have been anything else, for, as we have just seen, the cloudy atmosphere of Venus, which is dense and never lifted, would never permit any light from the sun or other outer source to reach the surface and be reflected as this French astronomer assumes it was. And even if the light could reach the polar cap of Venus it is admitted that that polar cap is not made of ice and so there would be no such ice-like reflection as the astronomer describes.

Here again we have a case in which the observed facts are explained by our theory, in which no other theory can be made to explain them, and in which, lacking our theory, the astronomers confusedly contradict each other when they try to reduce what they see to any rational explanation.

PROFESSOR PROCTOR ON MERCURY

And just to show the reader how universally our theory works, let us refer to another planet on which observations can be made of the polar openings. It is Mercury--the planet which is so near the sun that it circles around it in eighty-eight days. Of this planet Richard A. Proctor, one of the best known astronomers of the nineteenth century, says:

"It may be mentioned in passing that one phenomenon of Mercury, if real, might fairly be regarded as indicating Vulcanian energies compared with which those of our own earth . . . . would be as the puny forces of a child compared with the energies of a giant. It has been supposed that a certain bright spot seen in the black disc of Mercury when the planet is in transit, indicates some sort of illumination either of the surface of the planet or in its atmosphere. In its atmosphere it can scarcely be; nor could any auroral streamers on Mercury be supposed to possess the necessary intensity of lustre. If the surface of Mercury were glowing with the light thus supposed to have been seen, then it can readily be shown that over hundreds of thousands of square miles, that surface must glow with an intensity of lustre compared with which the brightness of the lime-light would be as darkness. In fact, the lime-light is absolute blackness compared with the intrinsic lustre of the sun's

surface; and the bright spot supposed to belong to Mercury has been seen when the strongest darkening-glasses (or other arrangements for reducing the sun's light) have been employed. But there can be no manner of doubt that the bright spot is an optical phenomenon only."

JUST LIKE SUNLIGHT

Again we agree with the observation but not with the inference. Here is a spot of light, plainly seen through a telescope, so bright that the observer compares it to the incandescence of a sun. It is a much brighter light than any mere reflection could possibly give. But we must remember that to Proctor such an appearance must have been staggering in the extreme. He was not only not expecting it but he was utterly unprepared to see such a phenomenon. And so he is utterly unable to explain it. And it is a safe rule that when you cannot explain a thing you can make what looks like an explanation by giving the thing another name. So Proctor calls this light "an optical phenomenon only." Well of course, it is an optical phenomenon, but why does he say "only?" Everything we see is an optical phenomenon, but we usually try to explain the optical phenomena. A man who saw optical phenomena that were without explanation or cause would be in a very dubious position. People would say he was "seeing things"--and their meaning would not be complimentary. But we cannot assume that Proctor's eyes had played him a trick. He was a trained astronomical observer. So what he saw must have had some explanation or cause behind it. He cannot have seen a "myth" as he himself asserts.

Now it is obvious to us that what he saw was the central sun of Mercury beaming directly through the polar aperture, and as Mercury is a small planet the interior sun would be rather near the aperture, certainly there would not be an aqueous atmosphere with clouds to darken its beams, and so that sun would shine with exceeding brightness. And it is notable that their beams did put Proctor in mind of the beams from the sun that shines in our heavens upon all the planets.

What more could be wanted than this to show that Mercury as well as the other planets has a central sun, that such a sun is to be met with universally?

Is it not significant that beginning with observations on Mars we are able

to go on to Venus and Mercury, apply the same tests, and get the same results? The tests, direct observation or photographic observation. The results, the invariable appearance of a central sun.

CHAPTER IV. EARLY POLAR EXPLORATION

One of the most prominent writers in England, a man, too, who had had a scientific education, was given a sketch of the main arguments in support of our theory, and he replied that our presentation of the facts would have absolutely convinced him if it were not for one thing--that the poles had actually been discovered. Perhaps this is the objection which is most often heard on the lips of people to whom our theory has been presented, and who do not agree with it. But that objection is fully considered and answered in the pages that will follow. What has actually been discovered by polar explorers? That is the question we shall ask of them, and the answers will always be in their own words, the records of their own observations, the findings of their own instruments and calculations.

A WORD IN ADVANCE ON PEARY

We shall follow the history of polar exploration from the earliest days in which real progress was made right through to the discoveries of Peary--and we shall see that what Peary discovered was not an actual polar point of solid ice at the apex of the world, but rather a point which he identified by the compass needle--which it should be remembered points to the magnetic and not to the geographical pole--and we shall further prove, from Peary's own recorded observations, from the statements he has made over his own signature, that in the actual polar regions there is every evidence of warm currents coming up from the interior, and that there is even stronger evidence than warm currents that the interior is open to the exterior in that region, and that the opening is what we have said it is and leads to what we have claimed it leads to. But that is to anticipate more than one of the chapters that follow. For the present we will follow the Arctic explorers, and, distinguishing between what they actually observe--which is dependable--and what they merely think--which is subject to error--we shall see all their testimony converging toward the establishment of what we have already set forth.

HOW WE CONVINCE SUCH CRITICS AS THE ONE ABOVE QUOTED

It is of course obvious that if our theory be true, the actual region of each pole will be warmed by the seas of the inner surface of the earth, and that these, warmed by the interior sun, will cause the climate around the polar openings to be a very mild one. The sea around the polar opening will be an open one. At some point on the arctic voyage the ice barriers will be passed and the voyagers will enter a region that grows warmer and warmer as they sail up to the polar opening and then over it and on into the interior of the earth. They would only know that they had actually passed over the lip by the peculiar behavior of the magnetic needle and by the fact that they would see above them as above would then mean toward the actual center of the earth--the interior sun which of course would be shining whether the voyagers came under its influence during the day or during the arctic night.

That is what would happen if our theory were true. The question is, then, has anything like that been actually observed? The answer is that every arctic navigator from the beginning has made observations which more and more agree with that view the further north the observers go. To show how unanimous this testimony is let us go back a good distance.

BARRINGTON'S IMPORTANT BOOK

In 1818 there was published in New York an American edition of a book entitled, "The Possibility of Approaching the North Pole Asserted," by the Hon. D. Barrington: A new edition with an appendix containing Papers on the same Subject and on a North-west Passage, by Colonel Beaufoy, F. R. S. Barrington, as well as Beaufoy, was a Fellow of the Royal Society, the greatest English scientific body, and he was convinced that the voyage to the North Pole was a possibility. In order to convince his colleagues in the Royal Society of this, he read a number of papers containing information that he had gathered from whalers and other voyagers in the Arctic. Here are some of the facts he deduced. In 17S1 a Captain Mac-Callam, commanding a whaler, during a lull in the usual business of the voyage, thought he would make a dash for the North Pole. He reached a latitude of 83½ degrees and he found in front of him no further ice, but clear water. In fact "they had not seen a speck of ice for the last three degrees." But he had to abandon his voyage as he did not wish to incur the displeasure of his owners. The author then cites another voyage, described to him by a Dr. Dallie of Holland who made a voyage on a

Dutch war-ship in supervision of the Greenland fisheries, on which voyage a latitude of 88 degrees was reached: "when the weather was warm, the sea perfectly free from ice, and rolling like the Bay of Biscay. Dallie now pressed the captain to proceed; but he answered that he had already gone too far by having neglected his station . . ."

BARRINGTON COMBATS IDEAS OF THE DAY

Before citing further from Barrington let us remind the reader that he is not arguing in support of our theory. He is simply calling to the attention of his contemporaries actual facts which he has collected and which seem to him to make the voyage to the pole more feasible than it was thought to be at the time--when of course the means of navigation were so much poorer than they are at present. At that time, too, it was the generally received notion that there was a perpetual barrier of ice whose boundaries corresponded more or less with a latitude of 80½ and that any discovery of the regions north of that would have to be made by a sort of wind-propelled sled, a mechanism actually used for traveling over the ice by the Dutch.

HIS REPORT TO THE ROYAL SOCIETY

This idea Barrington combated. He recalled to the Royal Society that as early as 1663 its secretary at that time had examined a traveler lately returned from Greenland, and that this traveler had told of a Hollander captain who claimed that he had come within half a degree of the pole, and corroborated it by showing his journal, the entries being attested by his mate. Now in view of later explorations it does not matter just how accurate that sailor was--the point is simply that even in those early days it was possible to get much nearer the pole than was supposed at the time, and simply for the reason that the water was open as one went north.

But Barrington has instance after instance of the same kind. He mentions in particular two Hollander whalers who in the seventeenth century--sailed to 89 degrees and found no ice but "a free and open sea."

SOME OF THE FACTS HE ADDUCES

It is also interesting to note that Barrington quotes a passage from the Philosophical Transactions for 1675 which says:

"For it is well known to all that sail Northward, that most of the Northern coasts are frozen up many leagues, though in the open sea it is not so, no, nor under the Pole itself, unless by accident."

Barrington, of course, was trying to show that the idea of a perpetually ice-bound pole was simply a bogy to frighten explorers away from the attempt to gain the pole, and so he devotes himself next to a consideration of the actual ice-conditions in the far north, and what he says is so sensible and to the point, that we may as well settle the question as far as the ice is concerned, by quoting from his pages. The popular idea, doubtless, is that it is so cold at the actual pole that the sea water there is frozen. But this is not the case at all. The ice we see in pictures taken in polar regions is not frozen sea-water at all. It is frozen fresh water. Here is a description of the actual character of Arctic ice which Barrington translates from a "Dissertation of Michel Lomonosoff, translated from the Swedish Transactions of 1752, entitled 'De l'Origine des Monts de Glace dans la Mer du Nord':

ICE CONDITIONS IN THE NORTH

"There are three kinds of ice in the Northern Seas. The first is like melted snow, which is become partly hardened, is more easily broken into pieces, less transparent, is seldom more than six inches thick, and, when dissolved, is found to be intermixed with salt. This first sort of ice is the only one which is ever formed from sea water.

ICE ONLY FROM FRESH WATER

"If a certain quantity of water, which contains as much salt as sea water is exposed to the greatest degree of cold, it never becomes firm and pure ice, but resembles tallow or suet, whilst it preserves the taste of salt, so that the sweet transparent ice can never be formed in the sea. If the ice of the sea itself, therefore, confined in a small vessel without any motion, cannot thus become true ice, much less can it do so in a deep and agitated ocean."

And Barrington adds: "The author hence infers that all the floating ice in

the Polar Seas comes from the Tartarian Rivers and Greenland."

It would be tedious to recount the many other instances of sailors reaching latitudes from 80 to 89 degrees given by Barrington, but the notable thing about his instances is that they reveal the fact that the sailors of those early days, the seventeenth and eighteenth centuries, all believed that the way to the pole was more or less open, and they believed it because the further north they actually reached the less ice they met with.

WITHIN FIVE AND A HALF DEGREES OF THE POLE

But Barrington has some other very interesting observations. He quotes a memorandum from the Astronomer Royal of England to the effect that a Mr. Stephens, sailing on a Dutch ship in 1754, was driven into latitude 84½ or within 5½ degrees of the pole. They "did not find the cold excessive, and used little more than common clothing; met with but little ice, and the less the farther they went to the Northward. . . It is always clear weather with a North wind, and thick weather with a Southerly wind. . . Says he has often tasted the ice when the sea water has been let to run or dry off it, and always found it fresh."

The author then goes on to cite many instances of warm weather near the poles warmer weather in fact than the observers had experienced at points many degrees further south. He sums up by saying:

"All our accounts agree that in very high latitudes there is less ice."

THE CONFORMATION OF THE POLAR BASIN

But although Barrington had no suspicion of the actual shape of the earth as our theory shows it to be, he did suspect that there was a depression of the earth's surface at the polar circle. In fact he cites an experiment of Sir Isaac Newton based on the swinging of a pendulum at various points on the earth's surface--the time of swing would vary according to the distance of the pendulum from the earth's center--and also the actual measuring of a degree at the Equator and at the Arctic Circle. "This last evidently proved the depression of the earth's surface towards the pole, which no doubt gradually increases."

We have only two more observations to make about Mr. Barrington's examples, before leaving his book for those of later explorers and writers--who will be found to corroborate his observations at every point. Then we shall leave him for the present but return to him in connection with some very interesting observations concerning actual evidence of an unexplored country which are found floating on the arctic seas.

REMARKABLE STATEMENT OF DUTCH CAPTAIN

Those two observations are from a Dutch sea captain and an English clergyman, then stationed at Petersburgh, respectively. The Dutch captain makes the remarkable statement that the most open sea to the northward--when in latitude 80, was not in summer as might be expected if the Pole were really solid ice, but "generally happens in the month of September" and this is in spite of the fact that the Arctic night is beginning then--in which surely we should expect the maximum of cold if the outer sun were the only factor in melting the ice, as the ordinary scientists have assumed it to be. The other observation, made by the English clergyman may be quoted in full as Barrington gives it:

"Mr. Tooke hath been assured by several persons who have passed the winter at Kola in Lapland, that in the severest weather, whenever a Northerly wind blows, the cold diminishes instantly, and that, if it continues, it always brings on a thaw as long as it lasts.

"He hath also been informed . . . that the seamen who go out from Kola upon the whale and morse fisheries early in March (for the sea never freezes there) throw off their winter garments as soon as they are from fifty to a hundred wersts (three wersts make two miles) from land, and continue without them all the time they are upon the fishery, during which they experience no inconvenience from the cold, but that, on their return, (at the end of May) as they approach land, the cold increases to such a severity, that they suffer greatly from it.

"This account agrees with that of Barentz, whilst he wintered in Nova Zembla, and of the Russians in Maloy Brun; the North wind cannot therefore, during the coldest seasons of the year, be supposed to blow over ten degrees of ice.

THE NORTH-WEST PASSAGE

"Governor Ellis indeed, whose zeal in prosecuting the attempt of discovering the North-west passage through Hudson's Bay is so well known, hath suggested to me an argument which seems to prove the absolute impossibility of a perpetual barrier of ice from 80½ degrees to the pole.

"If such a tract hath existed for centuries, the increase, in point of height, must be amazing in a course of years, by the snow, which falls during the winter, being changed into ice, and which must have formed consequently a mountain perhaps equal to the Peak of Tenneriffe. Now the ice which sometimes packs to the northward of Spitzbergen, is said commonly not to exceed two yards in height."

The reader may think this is a very old argument to be reproducing a hundred and forty years after it was first made. But we do so because the argument is as good today as when it was first made, and we wish to show that even in those days observations were made which have been corroborated and enlarged right down to the present day--all pointing irresistibly to one conclusion.

CHAPTER V. FURTHER ARCTIC EXPLORATION

Arctic Exploration in the nineteenth century opened out with the brilliant expeditions of Sir John Franklin, beginning in 1818, and when he was lost with 129 companions and the two ships which had been fitted out in 1844, a tremendous effort on the part of Great Britain, with the co-operation, too, of private individuals in the United States, was made to find him. Of course these explorers also made many general observations during their several expeditions, and it is from these that we will now proceed to quote many facts that lead to the conclusion that there is not only an open polar sea, as Barrington contended, but a fertile land beyond it.

EXPEDITIONS IN SEARCH OF FRANKLIN

Among these expeditions was that of Lieutenant McClintock of the. Royal Navy in the steam yacht "Fox" owned by Lady Franklin. This navigator makes three very interesting observations from our point of view. He met with Esquimaux living upon the east coast of Greenland as far north as latitude 76 degrees, and it could not be ascertained how much farther north they lived. It is noticeable that they were separated from the South Greenlanders by hundreds of miles of ice-bound coasts and impassible glaciers. He comments on this to the effect that many centuries before a milder climate might have existed, and that that might have rendered the migration north possible, but he himself doubts if that can be the correct explanation. We, however, shall have more to say on that question a little later.

OBSERVATIONS OF McCLINTOCK AND KANE

But the observations of McClintock were nothing like as voluminous or detailed as those of the other explorers of the day. Dr. Elisha Kent Kane sailed as surgeon and as scientific observer with the "Advance" which left America with the "Rescue" the ships being supplied by a wealthy New York man, Mr. Henry Grinnell, and the expedition sailing in 1852. Dr. Kane kept

an exhaustive journal of his observations, which he published in two volumes upon his return. An open polar sea was one of the subjects of search of the expedition.

From the time the party reached the polar regions Dr. Kane was astonished by the unexpected phenomena met with. Where the climate was expected to grow colder--as they approached the pole--it grew warmer. At that same latitude of 80 degrees, of which we have seen Barrington's records, Kane found indications of "north water all the year round" as one of his party reported. Another party, later, in practically the same latitude while exploring the Greenland coast reported that:

KANE FINDS LESS ICE THAN HE EXPECTED

"The wind blew strongly from the north, and continued to do so for three days, sometimes blowing a gale, and very damp, the tops of the hills becoming fixed with dark foggy clouds. The damp falling mist prevented them seeing any distance. Yet they saw no ice borne down from the northward all this time; and, what was more curious, they found, on their return south, that no ice had been sent down during the gale." Mr. Morton, one of the members of this party, describes this journey--which was northward from Cache Island (see Chapter XXIII of Kane's first volume). The party reached Kennedy Channel after another gale from the north and again there was no ice except what had come up from the south. Ultimately this party reached Mount Parry which was at that time, "the most remote northern land known upon our globe." After quoting many other details of this northern trip Dr. Kane comments on it as follows, and his comment is a reiteration of what Mr. Barrington had claimed many years earlier, and points to what are the facts in the case--although Mr. Kane has difficulty when he tries to explain them:

"It will be seen by the abstract of our 'field-notes' in the appendix, as well as by an analysis of the results which I have here rendered nearly in the very words of Mr. Morton, that, after traveling due north over a solid area choked with bergs and frozen fields, he was startled by the growing weakness of the ice; its surface became rotten and the snow wet and pulpy. His dogs, seized with terror, refused to advance. Then for the first time the fact broke upon him, that a long dark band seen to the north beyond a protruding cape--Cape

Andrew Jackson--was water. With danger and difficulty he retraced his steps, and, reaching sound ice, made good his landing on a new coast.

"The journeys which I had made myself, and those of my different parties, had shown that an unbroken surface of ice covered the entire sea to the east, west, and south. From the southernmost ice, seen by Dr. Hayes only a few weeks before, to the region of this mysterious water, was, as the crow flies, one hundred and six miles. But for the unusual sight of birds and the unmistakable giving way of the ice beneath them, they would not have believed in the evidence of eyesight. Neither Hans nor Morton was prepared for it.

"Landing on the cape and continuing their explorations, new phenomena broke upon them. They were on the shores of a channel so open that a frigate or a fleet of frigates might have sailed up it. The ice, already broken and decayed formed a sort of horse-shoe shaped beach, against which the waves broke in surf. As they traveled north, this channel expanded into an iceless area; 'for four or five small pieces'--lumps were all that could be seen over the entire surface of its white caped waters. Viewed from the cliffs, and taking thirty-six miles as the mean radius open to reliable survey, this sea had a justly-estimated extent of more than four thousand square miles.

PLENTY OF GAME IN FAR NORTH

"Animal life, which had been so long a stranger to us to the south, now burst upon them. At Renselær Harbor, except the Netsik seal or a rarely encountered Harelda, we had no life available for the hunt. But here the Brent goose, the eider, and the king duck, were so crowded together that our Eskimos killed two at a shot with a single rifle ball.

"The Brent goose had not been seen before since entering Smith's Straits. It is well known to the Polar traveler as a migratory bird of the American continent. Like the others of the same family it feeds upon vegetable matter, generally on marine plants with their adherent molluscous life. It is rarely or never seen in the interior and from its habits may be regarded as singularly indicative of open water. The flocks of this bird, easily distinguished by their wedge-shaped line of flight, now crossed the water obliquely, and disappeared over the land to the north and east. I had shot these birds on the

coast of Wellington Channel in latitude 74 degrees, 50 minutes, nearly six degrees to the south: they were then flying in the same direction."

That is to say the birds were then flying north as they were now flying north from a latitude of approximately 80 degrees, .50 minutes, and the question at once rises in the mind, why were they flying north? If these birds were dependent upon living sea-plants with living molluscous life on them for their food, and if they are, therefore, always to be found in open water, they could only be flying north for one reason and that reason is that there was open water north, and there could only be open water if there were a more temperate climate than the severe climate to the south that Kane has just described.

Kane goes on:

"The rocks on shore were crowded with sea-swallows, birds whose habits require open water."

As the party left the land marine birds also appeared, no less than four kinds of gulls being seen, and as Kane says, "it was a picture of life all round." Morton, he further tells us, had also seen a large number of flowers in his explorations.

Kane then proceeds:

"It is another remarkable fact that as they continued their journey the land-ice and snow, which had served as a sort of pathway for the dogs, crumbled and melted, and at last ceased altogether; so that, during the final stages of their progress, the sledge was rendered useless, and Morton found himself at last toiling over rocks and along the beach of a sea, which, like the familiar waters of the south, dashed in waves at his feet.

"Here for the first time he noticed the Arctic Petrel, a fact which shows the accuracy of his observation, though he was then unaware of its importance. This bird had not been met with since we left the North Water of the English whalers, more than two hundred miles south of the position on which he stood. Its food is essentially marine, the acalesphæ, etc., etc.; and it is seldom seen in numbers except in the highways of open water frequented by the whale and the larger representatives of ocean life. They were in numbers, flitting and hovering over the crests of the waves, like their relatives of milder

climates, the Cape of Good Hope Pigeons, Mother Carey's Chickens, and the petrels everywhere else. . . .

AN OPEN NORTHERN SEA

"It must have been an imposing sight, as he stood at this termination of his journey (past Sir John Franklin Island), looking out upon the great waste of waters before him. Not a 'speck of ice,' to use his own words, could be seen. There, from a height of four hundred and eighty feet, which commanded an horizon of almost forty miles, his ears were gladdened with the novel music of dashing waves; and a surf; breaking in among the rocks at his feet, stayed his further progress.

"Beyond this cape all is surmise. The high ridges to the north-west dwindled off into low blue knobs, which blended finally with the air. Morton called the cape, which baffled his labors, after his commander; but I have given it the more enduring name of Cape Constitution."

Dr. Kane goes on to say that this observation of open water to the north harmonized with the observations of all the other members of the expedition. He admits that he cannot explain it, and adds the following comment:

OTHER EXPLORERS HAD POSTULATED OPEN BASIN

"An open sea near the pole, or even an open polar basin, has been the topic of theory for a long time, and has been shadowed forth to some extent by actual or supposed discoveries. As far back as the days of Barentz, in 1596, without referring to the earlier and more uncertain chronicles, water has been seen to the eastward of the northernmost cape of Nova Zembla; and until its limited extent was defined by direct observation it was assumed to be the sea itself. The Dutch fishermen above and around Spitzbergen pushed their adventurous cruises through the ice into open spaces varying in size and form with the season and the winds; and Dr. Scoresby, a venerated authority, alludes to such vacancies in the floe as pointing in argument to a freedom of movement from the north, inducing open water in the neighborhood of the pole. Baron Wrangell, when forty miles from the coast of Arctic Asia, saw, as he thought, a 'vast illimitable ocean' . . . So, still more recently, Captain Penny proclaimed a sea in Wellington Sound . . . Unlike the others, however,

that which I have ventured to call an open sea has been traveled for many miles along its coast, and was viewed from an elevation of five hundred and eighty feet, still without a limit, moved by a heavy swell, free of ice, and dashing in surge against a rock-bound shore.

"It is impossible in reviewing the facts which connect themselves with this discovery, the melted snow upon the rocks, the crowds of marine birds, the limited but still advancing vegetable life, the rise of the thermometer in the water, not to be struck by their bearing on the question of a milder climate near the pole. To refer them all to the modification of temperature induced by the proximity of open water is only to change the form of the question; for it leaves the inquiry unsatisfied--What is the cause of the open water?"

Dr. Kane was not only impressed by the warmer climate toward the pole, however, but he records that in a large indentation in Dallas Bay they found the remains of an Eskimo village, surrounded by bones of seals, walrus and whale. And furthermore:

TRACES OF THE ESKIMO

"In impressive connection with the same facts, showing not only the former extension of the Eskimo race to the higher north, but the climatic changes which may still be in progress there, is the sledge runner that Morton saw on the shores of Morris Bay, in latitude 81 degrees. It was made of the bone of a whale and worked out with skillful labor."

That is not the first time the Eskimos have been mentioned by the explorers quoted in this chapter, and every time the mention of them is connected with the north rather than with the south. We shall find more of this sort of evidence as we go along.

HARD TO DETERMINE HIS LOCATION

To the claims of both Cook and Peary that they have reached the north pole we shall give detailed answers shortly. But there is one paragraph in Dr. Kane's record which we may as well quote while we are dealing with his observations, and it throws some light on the later claims made by some Arctic explorers and the doubts as to their locations expressed by others

(Hansen, for instance, in one place frankly admits that he was lost in the Arctic and had no wav of knowing where he was). Here is the passage, which refers to the difference between Kane's projection of the coast around Cape Isabell and that made by Captain Inglefield:

"The difference between our projection of this coast and Captain Inglefield's refers itself naturally to the differing circumstances under which the two were framed. The sluggishness of the compass and the eccentricities of refraction in the Arctic seas, are well fitted to embarrass and mislead a navigator. . . ."

It is interesting, too, to see that, in a note subsequently appended to these observations, Dr. Kane makes some other observations upon the distribution of the polar ice, and remarks: "I do not see how . . . this state of facts could be explained without supposing an iceless area to the farther north.

"How far this may extend,--whether it does or does not communicate with a polar basin,--we are without facts to determine."

But by following the observations of other and later explorers we shall endeavor to supply the facts whose absence left Dr. Kane so puzzled.

OBSERVATIONS OF DR. HAYES

We may now turn to the observations of one of Dr. Kane's companions, Dr. I. I. Hayes, who took a prominent part in the expedition and who wrote his account of it under the significant title, "The Open Polar Sea." Dr. Hayes went up Kennedy Channel, along the coast of Grinnell Land almost as far north as 82 degrees. Long before he had reached that point, however, he began to notice the strange contradictions that the arctic regions present. He passed into the Arctic circle on July 30, and was soon in the middle of a vast field of ice-bergs. He says of this experience:

"The air was warm almost as a summer's night at home, and yet there were the ice-bergs and the bleak mountains, with which the fancy, in this land of green hills and waving forests [that is to say, America], can associate with nothing but cold repulsiveness. The sky was bright and soft, and strangely inspiring as the skies of Italy. The bergs had wholly lost their chilly aspect."

That is sufficiently remarkable--surely indicating, according to what other explorers have already told us, in these pages, that the wind must have been from the north for the few days previous that would have brought some of the mildness from the actual polar regions down. If the reader is not yet convinced of that let him watch Dr. Hayes as he proceeds further toward that region. Conviction will follow.

MILD TEMPERATURES FOUND

By November 2, Dr. Hayes had reached Cape Alexander, on the Greenland Coast (Grinnell Land forms the other coast of Kennedy Channel which the explorers will soon reach) at a latitude of a little over 78 degrees. Here they were hit by a gale, strong enough to break up the ice and send it scudding away southwest. But Dr. Hayes is surprised by two things: Although the gale is from the north east, the temperature has all the time been very mild --in fact it has never been below zero, and moreover, when the gale had driven the ice away there was no more ice from the north to take its place.

WARMTH WHERE COLD WAS EXPECTED

By November 13th the party has proceeded a little further north, and Dr. Hayes, believing as he did that the pole was a solid ice-cap, is sorely puzzled by the actual phenomena with which he is met. Here is his diary, the first entry, "Worse and worse," referring to the fact that snow had been falling, which made it very disagreeable on the ship:

"November 13: Worse and worse. The temperature has risen again, and the roof over the upper deck gives us once more a worse than tropic shower. The snow next the ice grows more slushy, and this I am more than ever puzzled to understand, since I have found today that the ice, two feet below the surface, has a temperature of twenty degrees; at the surface it is nineteen degrees, and the snow in contact with it is eighteen degrees. The water is twenty-nine degrees.

"November 14. The wind has been blowing for nearly twenty-four hours from the northeast, and yet the temperature holds on as before. At ten o'clock this evening it was four and a half degrees. I have done with speculation. A

warm wind from the 'mer de glace,' and this boundless reservoir of Greenland frost, makes mischief with my theories, as facts have heretofore done with the theories of wiser men. As long as the wind came from the sea I could find excuse for the unseasonable warmth."

It is a pity that the open-minded spirit shown there is not more evident among other scientists. Dr. Hayes would have tried to explain that warmth if he could possibly have done so. But when the wind that brought it came no longer from a sea that was itself above freezing point but came from a land that was covered with ice, he was simply at his wits' end and frankly acknowledged that he could not account for the phenomenon. So he left it an open question. And it has really been an open question ever since--but it is at last closed.

Let us, however, follow Dr. Hayes still further north. By the end of November the Arctic night has set in. The voyagers are by now a little farther north. And yet here is the sort of thing that hap-pens to the temperatures:

"The temperature had been strangely mild, a circumstance at least in part accounted for by the open water, and to this same cause was due no doubt the great disturbance of the air, and the frequency of the gales. I have mentioned in the last chapter a very remarkable rise in the thermometer which occurred early in November (see above); but a still greater elevation of temperature followed a few weeks later, reaching as high as 32 degrees. In con-sequence of this sudden and unaccountable event, the thaw was renewed, and our former discomfort arising from the dampness on deck and in our quarters was experienced in an aggravated degree. . ."

Then snow began to fall, and Dr. Hayes was still more astonished--for this was above the line where snow usually falls--when it was followed by a shower of rain. He also noticed that the snow came in very beautiful and perfectly formed crystals, which is always, he says, a sign that the snow was formed in a temperature that is quite mild. "I have not observed them when the thermometer ranged below zero."

But by January 13 quite .a good deal more snow had fallen, and in spite of the fact that there had been terrific storms the air had never been really cold. (The party were wintering at Port Foulke.) The explorer notes these high winds and high temperatures, and snow, and says:

UNUSUAL PHENOMENA

"All these unusual phenomena are, as has been hitherto observed, doubtless due to the proximity of the open sea. How extensive the water may be is of course unknown, but its limits cannot be very small to produce such serious atmospheric disturbance. It seems, indeed, as if we were in the very vortex of the north winds. The poet has told us that the north winds

'*Are cradled far down in the depths that yawn Beneath the Polar Star*;' and it appears very much as if we had got into those yawning depths, and had come not only to the place where the winds are cradled, but where they are born."

We might say here that if the open sea really accounted for the high temperatures it follows that there must be a still greater source of heat to account for the open sea. And we should remember, too, that Dr. Hayes observed the same high temperatures when the northeast wind was coming across, the frozen surface of Greenland.

And let us also say that if the poet imagined a great space where the winds are born, beneath the Polar Star, the fact may again turn out to be more wonderful than the fiction--the depths may yet be plumbed. In fact we have indubitable proof that they can be plumbed and explored. But that we will discuss later.

At last the Arctic winter began to wear away. One of the first signs of the change in season was the appearance of a flock of birds, which, curiously enough, "warmed their feet in the water which the winds would not let freeze." The explorer was surprised to find these birds the Dovekie of Southern Greenland--"denizens of the Arctic night so near the Pole." But there again we must reserve comment until later.

A WARM SLEDGE JOURNEY

When the sun did arise the explorer left his ship and undertook a sledge journey whose object was to cross the frozen sound to Cape Sabine on its other side (just south of Grinnell Land). As a matter of fact he had to strike for a point north of that on account of the ice hummocks. Before long the

explorer finds that although the sea is now frozen over so that he can cross it in this manner, the air is quite warm. The warmth, he thinks, is "unseasonable," and it must have indeed felt so, for the party wished to take off their coats and could not as the added weight of the coats on the sledges would have been an unfair handicap for the dogs. At one time the members of the party wondered whether the ice was going to melt under them, and kept a watchful eye in the direction of Port Foulke. The author notes that along the entire coast of Grinnell Land, which could be seen in the distance, there were no glaciers, which he noted as being in striking contrast with the Greenland coast. At this point in Dr. Hayes' journey he had reached a point somewhat to the northward of that reached by Morton, the member of Dr. Kane's expedition whose observations we have already noted, being in fact at a point, "sixty miles to the northward and westward of Cape Constitution." He pushed on, and was soon stopped by bad ice. Returning to the Grinnell coast and climbing an elevation, the author made the following observations which had better be given in his own words:

"The ice was everywhere in the same condition as in the mouth of the bay, across which I had endeavored to pass. A broad crack, starting from the middle of the bay, stretched over the sea, and uniting with other cracks as it meandered to the eastward, it expanded as the delta of some mighty river discharging into the ocean, and under a water sky, which hung upon the eastern and northern horizon, it was lost in the open sea.

ON THE EDGE OF THE POLAR BASIN

"Standing against the dark sky at the north, there was seen, in dim outline, the white, sloping summit of a noble headland--the most northern land upon the globe. I judged it to be in latitude 82 degrees, 30 minutes, or four hundred and fifty miles from the North Pole. Nearer, another bold cape stood forth; and nearer still the headland, for which I had been steering my course the day before, rose majestically from the sea. .. .There was no land visible except the coast upon which I stood.

"The sea beneath me was a mottled sheet of white and dark patches, these latter being soft, decaying ice or places where the ice had wholly disappeared.

"I reserve to another chapter all discussion of the value of the observations

which I made from this point. Suffice it here to say that all the evidences showed that I stood upon the shores of the Polar Basin, and that the broad ocean lay at my feet; that the land upon which I stood, culminating in the distant cape before me, was but a point of land projecting far into it, like the Ceverro Vostochnoi Noss of the opposite coast of Siberia; and that the little margin of ice which lined the shore was being steadily worn away; and within a month, the whole sea would be as free from ice as I had seen the north water of Baffin Bay,--interrupted only by a moving pack, drifting to and fro at the will of the winds and currents."

BIRDS FLYING NORTH

Dr. Hayes was, of course, unable to proceed any further, as the ice was rapidly vanishing and rotten where it was exposed outside the bay. But before planting his flag and other evidences of his discovery and returning to his base at Port Foulke, he was surprised to note again those small birds, a flock of Dovekie. He expresses surprise at seeing them so far north so early in the season. He also saw a number of burgomaster-gulls which, significantly enough, were "making their way northward, seeking the open water for their feeding grounds and summer haunts." Rather curious, is it not, that these birds should be flying toward the North Pole in search of summer haunts and open water and food?

A PROPHETIC VISION OF OUR THEORY

And Dr. Hayes evidently felt to the full the strangeness of his situation and the possibilities that were hidden in that stretch of polar sea which he could not explore. Something of a prophetic vision would almost seem to be behind the following words with which he ends this chapter in his record:

"But I quit the place with reluctance. It possessed a fascination for me, and it was with no ordinary sensations that I contemplated my situation, with one solitary companion in that hitherto untrodden desert; while my nearness to the earth's axis, the consciousness of standing upon land far beyond the limits of previous observations, the reflections which crossed my mind respecting the vast ocean which lay spread out before me, the thought that these ice-girdled waters might lash the shores of distant islands where dwell human

beings of an unknown race, were circumstances calculated to invest the very air with mystery, to deepen the curiosity, and to strengthen the resolution to persevere in my determination to sail upon this sea and to explore its furthest limits; and as I recalled the struggles which had been made to reach this sea--through the ice and across the ice--by generations of brave men, it seemed as if the spirits of these Old Worthies came to encourage me, as their experience had already guided me; and I felt that I had within my grasp 'the great and notable thing' which had inspired the zeal of sturdy Frobisher, and that I had achieved the hope of matchless Parry."

We can understand those feelings. Often a vision of achievement like that has led men to make great efforts and those efforts have resulted in achieving not what they saw in the vision but something even better. It was not reserved for Hayes to discover what he thought might possibly be found. And he might think it a strange thing if he could revisit the earth and see that the first actual discovery of what is really at the "ends of the earth" is made not by an explorer with ships and sleds and dogs, but by an explorer of the facts which observations have gradually given us. It is not the actual explorer, collector of facts, or in an army, the actual scout, who wins the victories of science or of war. It is the philosopher who puts the facts together and draws inferences; it is the general who puts together the isolated tidings brought in by scouts. And so in this case. Kane and Hayes, Greely, Nansen and Peary, have indeed gathered in many a fact and observation. But the very nearness of these men to their own actual problems has perhaps prevented them from seeing the whole field at a glance. By taking all their results and comparing them with what the astronomers tell us of other polar regions and of the evolution of planets in this way only can the actual visions of men like Hayes be turned into the concrete reality of scientific knowledge. And then, once having achieved that, the task of the explorer is rendered much more easy and more fruitful, for he is guaranteed a definite goal, and knows just at what he is aiming.

But to return to Hayes. In a very interesting chapter he summarizes the available knowledge of the open polar sea. He first draws the reader's attention to the fact that the north coasts of Greenland and Grinnell Land are about the only boundaries of this sea which have not been well defined along their northern coasts. He also makes special note of the fact that while the boundaries of the Open Polar Sea are all within the line of perpetual frost, the

sea itself is open and all the serious attempts of polar explorers have had to reckon with this fact. For their difficulty has been to break through the ice barriers and to reach the open sea. He, himself, of course did reach this open sea but as he had come to it by sledge he was unable to take advantage of his discovery. Had he been able to get a ship up to that point all would have been easy--he might well have been the discoverer of the so-called "pole".

THE TEMPERATURES OF THE POLAR REGIONS

In this chapter Hayes prints a very interesting note about the temperature of the polar regions. If the pole is what it has always been supposed to be--namely a sheet of solid ice, the coldest part of the world,--it would follow that the closer we approached to it the lower the temperature would be. And even if the equator were not the parallel of maximum heat (for as a matter of fact that is only an approximation, and the actual parallel of maximum heat departs from the line of the equator) it would still be true that at, or very near, the place which has always been called the pole, there would be a spot where the temperature reached a perpetual minimum. But as early as the first serious attempts to get to the pole, it became evident that this was not the case--that the polar region was warmer than the regions immediately surrounding it. As early as 1821, Sir David Brewster, knowing that exploration pointed to a higher temperature at the poles wrote a paper in which he put forth the theory that figuring from the mean heat of the globe, compared with actual heat measurements on various parts of it, it might be found that the heat at the pole was ten degrees higher than at other points in the Arctic circle.

THE EARTH'S HEAT AND BREWSTER'S GUESS

But if we admit that Sir David Brewster's guess is right--and it is remarkable that, on the evidence available in his day he should have hit upon this idea--what can possibly cause that rise in temperature? If the poles were solid, or at least if they had no source of heat such as out theory predicates, how could they possibly reach that higher temperature? Where could the heat come from? Only if there were such an inner source as we indicate could this take place. And if there were such an inner source, Sir David Brewster's guess might prove to be remarkably accurate. For the heat coming from the interior of the earth would not make the whole polar basin into an ice-free

region. As we shall show later, there are icebergs and glaciers on the inner lip of the polar orifice. We shall show how mammoths have been entrapped in the crevasses of these glaciers and carried into Siberia in a freshly frozen condition. The polar ice of the external surface would be sufficient to cover the whole pole as well as the region which we speak of as the ice basin, if the polar region were solid. As it is not solid, but communicates with a warmer region, we have the ice from the outside forming a barrier around that region and also forming into ice-fields and glaciers on the inner rim, these latter, however, being prevented from becoming one solid mass by the warm currents from the hotter parts of the interior. It might well be, although we do not say this dogmatically, that the resulting mean temperature in the region that we may call the "lip" of the polar orifice would be found to be on the whole about ten degrees higher than the temperature further south, just as Sir David Brewster thought. But that actual temperature is a matter for actual observation by an expedition. Here we merely call attention to the curious fact that without knowing of this polar orifice a scientist was led to postulate such a relatively high and with difficulty explained temperature at what was thought to be the solid pole.

HAYES AGREES WITH WRANGEL

Before leaving Hayes, however, we may briefly note a number of interesting observations he makes all of which go to support our explanation of the true nature of the polar regions. Lest it be thought that the foregoing accounts of open water were simply due to temporary conditions it may be noted--on Hayes' authority--that as early as the time when Baron Wrangel, then a young lieutenant in the Russian navy made his polar attempts it was clearly proved that the open water to the north was always open whatever the time of year. He also quotes Dr. Kane's findings, whose explorations preceded his own and have been already described here. It may be noted that Wrangel found the open polar sea from an almost opposite point in the polar circle while Parry discovered it to be open from a point above Spitzbergen.

One of the most interesting of these closing observations of Hayes, however, deals with the Eskimo. An Eskimo to whom he spoke before his dash for the polar circle told him that he would find the tribesmen as far north as he could go. Dr. Hayes did find traces of them "up to the very face of

Humboldt glacier" and as far north as Cairn Point. Dr. Hayes goes on to say:

"The simple discovery of traces of Eskimos on the coast of Grinnell Land was not altogether satisfactory to Kalutunah, for he had confidently expected that I would find and bring back with me some living specimens of them; but he was still gratified to have his traditions confirmed, and he declared that I did not go far enough or I should have found plenty of natives; for, he said, in effect, 'There are good hunting grounds at the north, plenty of musk-ox (oomemak), and wherever there are good hunting grounds, there the Eskimo will be found.'

ANIMAL LIFE AROUND THE POLE

The importance of that point will readily be seen. Good hunting grounds means vast tracts of land that will support the animals, in which they can not only find food but opportunity for breeding. It means, in short, a salubrious climate. But to that point we shall return later, fortified with a vast mass of positive evidence.

That musk-ox is not the only animal to be found where we should hardly expect it is evident from another entry in Hayes' diary. When he was in latitude 78 degrees, 17 minutes, early in July, he says "I secured a yellow-winged butterfly, and--who would believe it--a mosquito. And these I add to an entomological collection which already numbers ten moths, three spiders, two bumble-bees, and two flies". One wonders where they all came from, especially the butterfly and the mosquito which have been known to find even the American climate too cold for them. But here again we shall not press the subject until we come to treat it in greater detail, for we have other explorers to follow and other evidences to record drawn from their experiences in looking for that pole which does not exist.

CHAPTER VI. GREELY'S EXPLORATIONS

We now come to the many and valuable observations made by General A. W. Greely, who as a young lieutenant in 1881 began his "Three Years of Arctic Service" (as he calls his book) by setting off on the "Lady Franklin Bay Expedition" one of the objects of which was to attain the old goal "farthest north".

A REMARKABLE PREFACE

In the preface to this book in which he recounts his experiences, General Greely tells us that the wonders of the Arctic regions are so great that he modified his actual notes made at the time, and understated them rather than lay himself open to the suspicion of exaggerating. That the Arctic regions are so full of life and strange evidences of a life further north that an explorer cannot tell them all without being accused of exaggeration is surely a very strange thing if those regions only lead to a barren pole of everlasting ice.

But let us see what those actual wonders are. Let us take Greely's own account of them noticing how perfectly it agrees with the accounts of earlier explorers. He proceeded along the coast of Greenland to Melville Bay.

THE CRIMSON CLIFFS

By August first he had reached a point near the Petowik glacier which lies just northward of the "Crimson Cliffs" of Sir John Ross. This is so called from the fact that on the snow-clad cliffs and glacier surfaces at this point Sir John Ross, in 1818, discovered a red deposit which had fallen about and mixed with the snow, giving it a reddish color which was pretty widely distributed. What was it? For a long time this was a mystery, but it was at last proven to be of vegetable origin: now, the point--to be taken up in detail later is simply this: where could any vegetable matter, either a pollen from larger plants or a very humble sort of red mossy or spore like growth, come from? There is no other case in the whole realm of botany that would justify us in assuming that a plant can grow on ice-bergs or on snow. A plant requires certain elements and certain temperatures. Evidently, somewhere those

factors must be in existence. Where, we shall see later.

ARCTIC TEMPERATURES

Greely's next observation of interest to us is that any errors in the reporting of arctic temperatures are likely to be on the side of making them too low. So that in case any readers have doubted the accuracy of previous explorers they may set their minds at rest.

When part of Greely's party had gone almost as far north on the Greenland coast as Newman's Bay, Sergeant Brainard made this rather remarkable discovery:

THE MUSK-OX

"Just before going into camp, Sergeant Brainard discovered on that winter's snow the dung of a musk-ox, which he thought could scarcely be a week dropped. He well says: 'This should be positive proof that the animal does not migrate south with the sun and return the following year as the sun advances, as many assume to be his habit, but remains in some well sheltered valley or ravine during the winter darkness, subsisting on whatever comes his way.' This incident (Greely adds) and my personal experience, as well as that of the British expedition, leaves no doubt that the musk-ox is a regular inhabitant of Grinnell Land and Northern Greenland the entire year.

We admit the above proves that the ox does not migrate to the south. For we have seen already other instances where the trend of animal and bird migration was not to the south. But in our other cases there was a migration. But it was to the north. It is absurd to suppose that the musk-ox, which is certainly not an eater of birds or a hunter of fishes, could live on "what came its way" in ravines, even sheltered ones during the Arctic winter. What would be wandering about the ravines or valleys of the bleak lands here mentioned, during the long Arctic night, anyway? No, the musk-ox goes for his winter where he can find food in abundance. And that is north--over the lip of the polar orifice.

LOCKWOOD'S OBSERVATIONS

One of Greely's assistants, Lieutenant Lockwood, explored the Greenland coast to a point ninety-five miles beyond the farthest ever seen by his predecessors. Among the results of his journey were observations of tidal and ice effects which convinced him that "open water spaces exist in the Polar Ocean, and its main ice moves the whole winter." This main ice, it will be remembered is the ice that forms the barrier to further sledge travel toward the north. That it is moving all the time proves conclusively that there is warmer open water to the north of it which is constantly breaking it up and keeping it from encroaching any further north. In this observation of his assistant General Greely concurs fully, and he gives additional data to prove that the polar pack ice is not unified and continuous "even in the early spring when the floe-ice is most solid".

General Greely also says that the depth of the sea at this high point augurs the inconsiderable extension of Greenland to the northward. He thinks it may extend to the eighty-fifth parallel and that deep sea will be found after that. That would certainly indicate that any land suitable for animal breeding and feeding--such as we have seen there must be--is still farther north, on the other side of that deep sea, in other words, over the lip of the polar orifice.

COMPLETE CONIFEROUS TREES

Greely then; gives us an account of some of his own explorations in Grinnell Land in the summer--Fort Conger being his base. Among his interesting discoveries were two complete coniferous trees in a ravine near Lake Heintzelman, embedded for two thirds of their length in the ground. "It seemed evident from their position that they must have been brought there as driftwood, and gradually covered up by the earth washing down from the adjacent hill side". Now the only explanation Greely could make of their drifting to that spot--it was twenty feet above the level of the nearby lake--was that "within a tolerably recent period this valley has been an arm of the sea". But that explanation hardly holds water. The trees were not fossilized and were partly ex-posed to air which, as Greely goes on to tell us--but without seeing how it invalidates his idea--was quite warm. Now in such circumstances the wood of the trees would soon rot away. Certainly warming and wetting and freezing and warming again due to being exposed in such a climate would soon finish any wood--much sooner than the time required for

the valley once near the sea to be left many miles away from it. No, it would seem as if those trees must have been carried from some other source.

And to regard them as carried by some glacial movement from the northern orifice would seem a much simpler explanation. It is interesting to note that this whole valley, by the way, was free from snow and covered with luxuriant vegetation. And, as was indeed the case generally in these explorations, there was an abundance of animal life observed.

BUTTERFLIES AND BEES

A little later Greely passed to the other side of this valley and found that he had reached the water shed of this part of Grinnell Land, the other side of the ridge draining into Lake Hazen. Here he did actually see a glazier on the north side of that lake--which ought to have given him a hint about the two trees he had so recently discovered. He also caught, at that point, a butterfly, and saw three shuas, two bumble bees and many flies. A little later a member of his party saw two tern and a long-tailed duck. What was even more remarkable, they next came across a flock of twelve to fifteen birds which resembled snipe but were unlike any actual species of that bird he had ever seen or read of. Other ducks were also seen and nine musk-oxen. Incidentally, a few nights the party were unable to obtain much sleep owing to the large number of flies which bothered them incessantly. The temperature was as high as 50 degrees Fahrenheit, and never went below 47 degrees and there was always enough dead willow around for fuel. As the days went on, more musk-oxen were seen, a great variety of birds, and quite a little reindeer moss--although it was considered that it never grew as far north as Discovery Harbor. Near Lake Hazen a deserted Eskimo encampment was found, its surroundings "marked by luxuriant vegetation of grass, sorrel, poppies, and other plants. Some specimens of the sorrel in this locality must have been eight to ten inches in height, and they grew in such quantities that we plucked them by the handful.

"A short distance beyond the encampment the party were enlivened by the appearance of a young hare, which we concluded to catch. . . .These exertions caused profuse perspiration which saturated our clothing." At the junction of Lake Hazen and Ruggles River, the air was so balmy, the sky so blue--flecked with true cumulus clouds so rare in the Arctic, and the poppies and

other flowers so gaily blooming that Greely said he could well imagine himself in the "roaring forties" instead of in this high latitude--eight degrees from the pole. He goes on:

"I examined carefully the surroundings of the camp. The flora appeared to be the same as that existing in the vicinity of Discovery Harbor, with the exception of two flowers which were different from any others I had seen. Specimens were procured and carefully arranged, but unfortunately were spoiled during my trip by being soaked beyond recognition while fording the many streams."

A FLOWER OF UNKNOWN SPECIES

"It is to be regretted that I paid but little attention to the Arctic flora, and in the press of other matters neglected to make a description of these plants. Another plant, of the heath family, was found in large quantities, one or two specimens of which were sent back to Conger."

Yes, we regret too, that that plant, so strange that Greely could not even approximately place its family, was not preserved. It might have shown us that there are other places from which plants may come as well as those regions which we know so well that all the plants that grow in them are identified and classified.

AN ESKIMO ENCAMPMENT

The next interesting discovery was of Eskimo inhabitants in which the explorers found a variety of articles including "several articles of worked bone whose use I could not surmise, and the character of which were unknown to our own Eskimo. The bone articles were of walrus, narwhal, and whale-bone, the first being the predominating material, from which small articles had been made."

That is a very interesting point, for this reason. The same tribes living under the same circumstances would naturally have the same tools. The fact that these long departed people whose habitations were now being explored had tools the use of which could not be guessed by the Eskimo with the party shows that they were a tribe who had not been in communication with any of

the Eskimo tribes we know, but who had developed along their own lines and made their own tools for their own purposes. Is it not quite possible that they had come up from the land the other side of the orifice at some time long past?

This supposition is strengthened by the fact that their houses showed no sign either of having been covered with stones or of having stones around them to secure the skin coverings as they are secured by the Greenland Eskimos. Either they covered their houses in some way peculiar to themselves or they never covered them at all. In any event here was a peculiarity which set them off from the ordinary Eskimos. The explorers searched diligently to see if the remains of any of these people were to be found. They had left so much apparently valuable material that it looked as if they might have died there. But with the most diligent searching, not a bone could be found--and Greely adds that not even the bone of a dog was visible although the camp looked as if the people had lived there for at least two years. He adds, by the way that bones of musk-oxen or other animals are very rarely found in Grinnell Land. And that can surely only mean that there is some way by which these animals can leave Grinnell Land.

TEMPERATURE RISES CONSIDERABLY

At about this time, by the way, the temperature had gone up to 74 degrees Fahrenheit--a very high summer temperature which made marching uncomfortable. And even on hills two thousand feet high there was not a trace of snow.

GENERAL RESULTS OF EXPEDITION

Greely ends the account of these summer explorations by telling the general results obtained by himself and his party. He says he has ascertained beyond any doubt that the interior of North Grinnell Land is not what it had always been supposed, but was a fertile land, filled with rich pasturage for musk-oxen, and that, like it, Greenland, was also only an ice-girt and not an ice-covered land; that in conjunction with other explorers' observations--it was safe to say that in north Greenland also there was abundant pasturage and fertility. Such fertility, he adds, Nordenskiold had looked for, but he had

looked seven hundred miles too far south. In other words Nordenskiold found only the icy desolation which is usually thought to characterize the poles, but he found it not because he got too near the pole but because he was not near enough.

HUNTING WAS GOOD

So ends the first volume of Greely's account of his three years in the Arctic regions. The second volume opens with his account of his second winter there. Throughout that period there was plenty of hunting, birds of many species being shot and owls caught and kept in captivity, as well as a white fox. Before proceeding to describe his further explorations Greely sums up his ideas regarding physical conditions to the north of Greenland. Of course he believed in a polar area which was not open to the interior--but all the same he is sure that that supposed area is "washed by a sea which, from its size and consequent high temperature. . . . can never be entirely ice-clad". He also states that Nordenskiold believes the polar sea to be open. That ships in the ice during Arctic winters nevertheless drifted--along with the ice--to the northward he thinks is confirmatory evidence of such an open sea. And yet he hesitates to say much about the matter himself as he thinks that the ice-belt which cuts off the far northern regions may be very thick and hard to get through. This makes him think that "the water space to the northward can only be entered in extremely favorable years by the Spitzbergen route." But the great point is that Greely admits there is a water space to the north.

We now pass on to the observations in ethnology and natural history which Greely made during these explorations. How far north did he find evidence of human life? He quotes the explorers in the British Polar expedition of 1875 as finding such evidences in 80 degrees, 25 minutes north, and proceeds:

ESKIMO REMAINS

"Our own discoveries of Eskimo remains to the northward of the eighty-first parallel were numerous and interesting. Evidences of temporary or permanent occupation noted at Cape Baird, at the head of Ella Bay, at numerous points in the vicinity of Fort Conger, in Black Rock Vale, on the

shores of Sun Bay, on both sides of Chandler Fiord, and in the valleys in the south side of Lake Hazen. Many of these remains were in the interior of Grinnell Land at distances from the sea varying from fifty to one hundred miles by the route necessarily followed."

The reader will remember the detailed description of one of these discoveries which we have already quoted. He goes on:

"The remains indicate that these natives possessed dogs, sledges, coniferous wood in considerable quantity, stone lamps, iron in small quantities, the bone of the narwhal and walrus. The presence of combs proves that they were accompanied by women. The ornamentation of the combs, and an elaborately worked ivory cap for the top of an upstander, show that these people were above the lowest levels of savage life."

'We have already noted the fact that some of these houses indicated permanent residence but that there were no graves, showing that the Eskimos had access to some unknown localities. And here is some more evidence bearing upon that very interesting point:

WHERE DID THE ESKIMO GO?

"Much as I could have wished to find evidences of long continued occupancy of these lands by the Eskimo, yet I was forced to a contrary conclusion. The lack of graves only is quite conclusive on this point. I opine that favorable years and the migration of the reindeer and musk-oxen gradually led these natives northward along the coast of Grinnell Land, and later into its interior. Of the many abandoned encampments in Grinnell Land only two evidenced other than temporary occupancy, and these, judging from the surroundings, of but few years."

Seeing, however, that these discoveries were made so far north it immediately occurs to us to wonder why Greely supposes that these Eskimos must have come up from the south and then disappeared into the north. If the northern lands past the ice-barrier are so fertile that these Eskimos were gradually led to explore them and settle there for we have no evidence of their ever retracing their steps is it not just as sensible to suppose that they came from there in the first place, and that the encampments Greely saw

represented these people's "furthest south" rather than a northern adventure. And the fact that they differed so much from the Eskimos with whom Greely was acquainted the reader will remember the tools whose uses he could not make out--certainly strengthens this view. In fact Greely admits that one other explorer, Fielden of the British expedition, who thinks that a section of the Eskimo race known as the Arctic Highlanders did come from the north.

WHALE AND OTHER ANIMALS

Now as to natural history notes. Greely saw the white whale in Smith Sound as far north as 81 degrees, thirty-five minutes, and a school of narwhal was seen at the same time. Perry, he says, in 1827 saw a white whale five minutes further on. He makes further notes on the presence of the narwhal and says that there is evidence to show that this creature "reaches even the polar sea to the north of Grinnell Land, as a horn was picked up near Floeberg Beach in 82 degrees, 27 minutes, by Lieutenant Parr."

We now turn to the musk-ox. We have already seen traces of this animal described by Greely. In these notes he tells us some very remarkable things about their distribution. It seems that there was hardly an island among those he visited in the far north where there were not traces of musk-oxen. He thinks they must have crossed Smith Sound at one time, as their skulls have been found in Inglefield Land north of the seventy-eighth parallel. Members of his party discovered them as far north as 83 degrees, 3 minutes north. Where did they come from? While Greely does not know he makes one valuable statement. He found out by actual trial that the musk-ox will not travel over ice: "both from observation of our musk-calves who could not be driven on it, and from the tracks of adults, which followed carefully in places the rough, rugged shore of Ruggles River rather than cross snow-covered ice by a shorter route."

So it is obvious that these animals must have some permanent and all year round northern habitat from which they emerge at times for breeding purposes, and this habitat can hardly be other than the comparatively warm polar area which communicates with both the outer and the inner surfaces of the earth.

Coming to smaller animals we find that the ringed lemming, a member of

the rat family, is found in great numbers in the extreme north of Grinnell Land and in Greenland as far as 84 degrees, 24 minutes north, and although the animal loves to wander but hates to travel on ice, it is not found further to the south--showing that all its freedom of movement is toward the north. The polar hare has also been found in latitude 83 degrees, ten minutes, and both in Greenland and Grinnell Land. Also it has been proved, by Greely and others that the lemming and hare do not hibernate in these latitudes.

In connection with the polar bear Greely makes these interesting statements:

WHY DO HERBIVOROUS BEARS GO NORTH?

"Lieutenant Lockwood, in May, 1882, noticed bear tracks (going northeast) on the north coast of Greenland, near Cape Benet in 83 degrees, 3 minutes, the highest latitude in which the animal has ever been known. . . . Fresh bear tracks were seen in September and October, 1883, near Cape Sabine, coming from and returning in the direction of Bache Island. . . .

"With Feilden I cannot understand why the bear ever leaves the rich hunting-field of the 'North Water' (the name of a land or district) for the desolate shores of the northward. Nordenskiold has pointed out that the bear is sometimes a herbivorous animal, but vegetation and animal life are equally scanty to the northward from Cape Sabine."

Had Greely been in possession of the facts laid bare in this book he would not have wondered. Naturally he and the other explorers mentioned above were considerably astonished when they saw that bears went away off north apparently to no-where, but the bears must certainly have known where they were going.

Greely then goes on to give instance after instance of the appearance of the fox in these latitudes, as well as of the wolf and the ermine. He next takes up the ornithology of the region. After mentioning a number of other birds seen in latitudes above 80, he has this very remarkable observation:

A BIRD THAT LOVES THE ARCTIC

"Ross' Gull. . . The observations of Murdoch at Point Barrow show that this bird, in thousands, passes over that point to the northeast in October, none of which were seen to return. He says, 'They appeared to come in from the sea to the west or north-west, and travel along the coast to the northeast.'"

If these birds never returned south, where did they go? Our theory supplies the only possible answer.

We will leave Greely's observations on the Aurora Borealis--which can only be fully explained by our theory--for a separate chapter.

GREELY TELLS OF HIS DISCOVERIES

After Greely had been rescued and brought back to civilization there was naturally a great deal of discussion as to the extent and value of his observations. Perhaps the most important announcement that Greely himself made--although it might not have been considered so at the time, for it was not understood was that before the British Association for the Advancement of Science. That body met in Montreal in 1884, and Greely addressed them. Here is part of what he had to say, taken from a report of the meeting printed at the time in "The Scientific American" and which was reprinted in many places.

Greely remarked that one of the, surprises of the journey was his discovery that the further north he went the greater was the depth to which the ground thawed. While Lieutenant Ray took observations at the point where his station was established--where he waited while Greely went on to the north--Greely took similar observations ten degrees further north than Ray, and he found that at almost his northernmost point the ground thawed for a depth of twenty to thirty feet. On the other hand, Ray did not find the thaw extending to anything like that depth--at ten degrees further south.

THE FARTHER NORTH, THE WARMER

Now that is proof positive that the further north, after a certain point one goes, the warmer it becomes. Other evidences of warmth at the Arctic have been derived from observations of the temperature of water and air currents, but it is very interesting to have this additional testimony based on the

temperature of the earth itself.

TIDAL FLOW OBSERVATIONS

But that was not the most startling thing Greely had to say. The report from which we quote goes on: "In a subsequent speech he (Greely) took occasion to say that a fact had surprised him. It was the discovery that when the tide was flowing from the north pole it was found by his observations that the water was warmer than when flowing in the opposite direction. He took the trouble to have prepared an elaborate set of observations showing this wonderful phenomenon, which would eventually be published. To him these peculiarities were unexplainable, and he hoped that the observations would be studied by his hosts, and some explanation found in regard to the thermometric observations of the expedition."

About the same time as the above meeting took place, Mr. George Kennan of Washington, D. C., who took a prominent part in the relief of Greely's expedition, was asked about the importance of his discoveries. (See Dieck's Wonders of the Polar World). Mr. Kennan said:

"Lieutenant Greely has not only taken away from Commander Markham of the British Navy the 'blue ribbon of Arctic discovery' for the highest latitude ever attained in any part of the world, but he has greatly extended the limits of the Nares explorations both in Greenland and Grinnell Land, and has given a severe blow to Captain Nares' palaeocrystic ice, and the theories which the latter founded upon it. The fact that two of Greely's sledge parties were stopped by open water in the polar basin, and that both were at times adrift in strong currents which threatened to carry them helplessly away northward, would seem to show that the polar basin is not the solid sea of ancient, immovable ice which Nares described, and which he declared was 'never navigable.'"

OPEN WATER AND WARMER

Now there is testimony of the most unimpeachable character and it is as plain as it is unimpeachable. There is no misunderstanding it. We find Greely ten degrees farther north than Lieutenant Ray, finding not merely that the winds and waters were warmer than further south but that this warmth was so

constant that the ground thawed to a depth of thirty feet. We find that whenever water flowed from the north pole it was warmer than when it flowed from the south. We find that there is no sea of "ancient ice" as Nares and explorers before him thought but that there is an open polar basin with strong currents. Now if that open water that stopped Greely were only a small sea that did not extend very far, there would be no such currents in it as are described above. Those currents testify to the fact that here is a sea which does extend to the northern regions. Of course Greely could not imagine how those warm currents could come from the north and he could not account for the strong currents in the sea. But our reader, who remembers the conformation of the polar regions, can easily see how these things would be. The water inside the polar orifices, warmed by the inner sun, would naturally form a very strong current as it met the cooler waters of the outside polar regions. Quite as naturally that water would keep clear from ice the great polar sea. Ice from the south could only come up to a certain point--the point where Greely and other discoverers found "open water"--and after that the sea would get warmer and warmer. It is interesting to note that one of the people interviewed in regard to the Greely discoveries at the same time as the other speeches and interviews were made, which we have quoted, said that further Arctic exploration had better be postponed until air ships could be built with which to undertake it. Well, at the time that may not have sounded like a practical suggestion, but it is now a thing of the very near future. And we shall see then just what one would expect from the observations made by Greely. For there is only one possible explanation for them and that is the explanation given in this book.

CHAPTER VII. NORDENSKIOLD'S VOYAGES

The next Arctic explorer whom we shall follow in his voyages is Adolf Erik Nordenskiold whose experiences in the Arctic extended over twenty-one years. Nordenskiold was a Finnish professor, and on all his expeditions he was accompanied by a staff of scientists. So the following observations are no mere pieces of unsupported guess-work but the findings of a man whose name has been made known the world over by the brilliant and thorough-going nature of the discoveries he made.

TWENTY-ONE YEARS' WORK

Nordenskiold's Arctic expeditions were made under the auspices of the Swedish government. His first serious attempt at a polar voyage was made in 1861, starting out from Tromsoe for a comprehensive survey of Spitzbergen. The party had just passed Amsterdam Island, according to Alexander Leslie who prepared the book, "The Arctic Voyages of Adolf Erik Nordenskiold," when a very interesting observation was made. Here is the account of it:

BIRD AND INSECT LIFE

"During the whole voyage no birds had been seen but auks and black guillemots, on their way northward in immense flocks to revisit their old breeding grounds. The same night, however, (23rd May), great numbers of barnacle geese (Anser bernicla) were seen flying towards the northwest, perhaps to some land more northerly then Spitzbergen. The existence of such a land is considered quite certain by the walrus-hunters, who state that at the most northerly point hitherto reached such flocks of birds are seen steering their course in rapid flight yet farther toward the north."

Passing over Nordenskiold's notes on the abundance of insect and other life in Spitzbergen, we note his surprise at the sudden way in which summer heat set in. In July the ice suddenly began to break up especially where it had been undermined by the waves--which would also sound as if the water of the sea had already reached a fairly high temperature. He was also surprised at the immense number of auk which he found as soon as he began his summer

expeditions. "Between Dym Point and Cape Fanshawe the Swedes passed the greatest auk-fell they had hitherto seen. . . . The air is darkened by the number of fowl flying out of such a fell when a gun is fired, without it being possible to distinguish any diminution in consequence in the number of those which sit still so quietly that some, which had made their nests, could be reached from the boat and taken with the hand."

"The party next entered Lomme Bay and after landing found a grassy terraced slope on which they killed three deer. The party could hardly believe them to be the same species of deer that they had seen at Treurenbery bay four weeks before. Then they were as lean as if they had consisted entirely of skin, bones, and sinew; these, on the contrary, might have competed as fat stock. . . ."

VOYAGE AFTER VOYAGE CONFIRMS OBSERVATIONS

Now it is interesting to note that these observations were confirmed and extended by Nordenskiold's further researches, and eleven years later we find him making similar discoveries and having this to say about them (this observation being made when he was on Parry Island):

"Numerous traces and remains showed that even these islands lying in the neighborhood of 81 degrees are inhabited in great numbers by very large animals, which, if the facility of procuring the necessaries of life were the only condition of their choice of habitat, ought to betake themselves to far more southerly regions. Numerous foot-prints of bears, often following the traces of the reins for long distances, showed that a dangerous enemy to the reindeer lives in this neighborhood."

A little later the explorer notices that the reindeer they shoot are, as he had once noticed before, much fatter than those shot in his southerly journeyings.

Now those facts. are sufficiently remarkable, but we will not dwell upon them now because we have further evidence along the same line that will be developed later in this book and that simply explains once and for all the reason of these observations which puzzled this great scientist.

More in line with the sort of evidence which we are now particularly considering are Nordenskiold's observations upon the actual character of the

northern lands. We first note that his views coincide with the other authorities we have quoted as to the ice only reaching to a certain latitude and then ending. Here is what he says on that subject:

EXPLORERS TOO AFRAID OF ICE, HE SAYS

"Of this inland ice the natives entertain a superstitious fear, an awe or prejudice, which has, in some degree, communicated itself to such Europeans as have resided long in Greenland. It is only thus that the curious fact that in the whole thousand years during which Greenland has been known, so few efforts have been made to pass over the ice farther into the country can be explained. There are many reasons for believing that the inland ice merely forms a continuous ice frame, running parallel with the coast, and surrounding a land free from ice, perhaps even wooded in its southern parts, which might, perhaps, be of great economical importance to the rest of Greenland."

ESKIMOS GO NAKED

Again, some years later than the time at which the above observation was made, the explorer on his "North-east passage expedition" noticed that at certain points which he was enabled to visit along the northeastern coast of Siberia, the absence of what geologists call "erratic blocks" or blocks of earth and rock moved by glaciers. This absence proved to him that there does not exist "in the sea to the northward any such glacial land as Greenland." He also made an observation which is very interesting taken in connection with our note in the last chapter about the Eskimos. The women of the Eskimo tribes with whom he came in contact on this voyage, whenever they are in their inner tents, "go quite naked, with the exception of a narrow girdle, probably a reminiscence of the dress the people wore when they lived in a milder climate."

It will be noticed that between the Eskimo memories of a milder climate and all the evidence of a milder climate provided by the abundance of animal life always going to the north to feed or breed we are having quite a lot of warmth in our polar explorations. And Nordenskiold noted on this same voyage that the north seemed to be the source of heat. He says in one place:

WARM WEATHER COMES WITH WIND FROM NORTH

"The wind had now changed from west to north and northwest. The temperature became milder and the weather rainy, a sign that there must have been great stretches of open water to the north and northwest."

CHAPTER VIII. WITH NANSEN IN THE NORTH

Nothing can illustrate better how really ignorant the scientists have been concerning the real constitution of the polar regions than the ridicule which many arctic explorers, and especially Greely, who seemed to believe in his later years that the pole was really a solid sheet of ice, cast upon Nansen when he announced his plans for a polar expedition.

SCIENTISTS LAUGH AT NANSEN

It was in the spring of 1888 that Fridtjof Nansen startled the scientific world "by announcing his determination to cross the ice-dome of Greenland." Nansen's idea was that instead of starting to explore Greenland from the west coast, leaving behind stores and a refuge that could be turned back to in case of failure, to start from the barren east coast and make toward the west where there were settlements and help. Thus if he got half way across and found great difficulties the natural thing would not be to turn back as was the temptation when food and shelter were behind and only further hardship in advance. It was on the expedition so planned that Nansen observed "a teeming current on the east coast of Greenland, piling the floes into the south"; he had found the same on the west side.

HOW THE JEANNETTE DRIFTED

"He had learned that wreckage from the Jeannette had drifted through the polar sea and to Julianehaab in the southern part of Greenland; also that Siberian larch and other woods indigenous to northern Europe had been found on the Greenland shores. . . . "--as his story is summed up in D. M. Edwards'"The Toll of the Arctic Seas." So, arguing from these facts, he further startled the scientific world by announcing that it would be possible to build a ship strong enough to withstand all the ice buffeting and drift in it across the polar sea. He was not trying to find the exact mathematical point that formed the earth's extremity, he said, but "to investigate the great unknown regions that surrounded the Pole."

GREELY IS SKEPTICAL

Greely denied that the wreckage which had been found was that of the Jeannette she was the ship on which De Long sailed for the Arctic in 1879--and he did not think that the Fram--as Nansen's ship was called--could stand the pressure of the Arctic ice. It is a curious thing that Greely should have, after all his arctic experience, gone back to such old-fashioned ideas as he seemed to have, but he painted a picture of what the ship would have to endure which was quite falsified by events--and in fact, Greely admitted, after Nansen came back, that he had been wrong. So much for scientific infallibility. Let us now follow Nansen upon his two explorations that across Greenland and that which attempted the pole, and see what a lot of evidence he gathers which all points in one direction.

NANSEN IS SUCCESSFUL

On the Greenland expedition--which was quite successful, even to fulfilling practically every plan which Nansen has scheduled he found evidence that while the lower part of Greenland was covered with an immense ice dome, rising to approximately 8,000 feet above sea-level, there was every evidence of fertility and warmth further north and a more open sea along the coast of Greenland as the party skirted it to the north in the small boats which they had carried overland with them.

MOSQUITOES IN GREENLAND

'While they were still on the east coast, traveling north, a swarm of mosquitoes attacked the party one morning and made life miserable for them. They were so thick that the explorers could not get their food into their mouths before it was covered with the insects. And Nansen adds that Greenland is, as a matter of fact one of the worst countries in the world for that pest. The east coast was also found prolific in sea-fowl, including gulls, guillemots, and eider-duck. In a fresh water tarn in a meadow they found a new species of fish. Sorrel grew in abundance. On some nights it was too warm to sleep in the tent. In talking to the Eskimo and in reading accounts of earlier explorers, Nansen constantly heard legends and rumors of the fertile land to the north--behind the ice barrier. Nansen also tells of a dust on the ice

which was observed by Nordenskiold and which he thought came from some other planet. Nansen, however, thinks that it is simply dust from some mountains that are not covered with ice and that it is blown over to the Greenland ice sheet. But it seems as if the quantities were too great to assume that it comes from any of the mountains known to explorers in those regions. We would be inclined to think that it comes from the other side of the polar ice-ring--from the land to which this book gives us the key. He also recounts, on the authority of Nordenskiold, the appearance to that explorer when in Greenland, of two ravens flying from the north: pretty good evidence that there was land there that was not covered with ice. After Nansen had penetrated the interior for some distance he was visited by a snow-bunting which was flying north--thus strengthening the evidence supplied by the two ravens.

SUCCESS LEADS TO FURTHER PLANS

But the chief importance of Nansen's first expedition was that it led him to think he could reach the north pole, and it is on this second journey that he really begins to make remarkable observations.

By the beginning of 1894, Nansen was between 79 and 80 degrees north, not making very rapid progress as they were shut in by the ice and dependent on the drift. And then Nansen noticed that whenever the wind blew from the north the temperature rose considerably. He says:

WARMTH WITH NORTHERN WINDS

"It is curious that there is almost always a rise of the thermometer with these stronger winds. . . . A south wind of less velocity generally lowers the temperature, and a moderate north wind raises it. Payer's explanation of this raising of the temperature by strong winds is that the wind is warmed by passing over large openings in the ice. This can hardly be correct, at any rate in our case, for we have few or no openings."

Nansen's own idea was that the heat was caused by winds from the higher reaches of the atmosphere where it had not been cooled by contact with the ice. But in trying to explain the high temperatures in this way he forgot that it was only the north winds which raised the temperatures and not the south

winds. And where would the higher air get its heat from in any case? The heat must come from a definite source and in the far north the only possible source is the one which we have pointed out.

MEETING A WALRUS

The explorers had reached 79 degrees, 41 minutes when suddenly one day on the ice they observed a large walrus. Nansen--who was out on the ice--rushed back to get a harpoon but by the time he secured it the animal had disappeared. There were no openings apparently in the ice, but the animal had vanished. He regrets that they were not prepared to capture it, but adds:

"But who expects to meet a walrus on close ice in the middle of a wild sea of a thousand fathoms' depth, and that in the heart of winter? None of us ever heard of such a thing before; it is a perfect mystery."

SUN UNEXPECTEDLY SEEN

When the party reached 80 degrees, 1 minute, a remarkable observation was made which may be explained in more than one way:

". . . . about midday we saw the sun, or, to be more correct, an image of the sun, for it was only a mirage. A peculiar impression was produced by the sight of that glowing fire lit just above the outermost edge of the ice. According to the enthusiastic descriptions given by many Arctic travelers of the first appearance of this god of life after the long winter night, the impression ought to be one of jubilant excitement; but it was not so in my case. We had not expected to see it for some days yet, so that my feeling was rather one of pain--of disappointment, that we must have drifted farther south than we thought. So it was with pleasure I soon discovered that it could not be the sun itself. The mirage was at first like a flattened-out, glowing red streak upon the horizon; later there were two streaks, the one above the other, with a dark space between; and from the main-top I could see four, or even five, such horizontal lines directly, over one another, and all of equal length, as if one could only imagine a square dull-red sun, with horizontal streaks across it."

COULD IT BE REFLECTION FROM INTERIOR?

Now it is quite a question whether the mirage that Nansen saw at this time was a mirage of the sun in our sky or whether it might not have been some sort of a reflection of the sun of the interior of the earth. Certainly he was not expecting to see the solar light at that time.

Two or three days later this mirage of whichever sun it might have been was seen again.

By spring the party had reached 80 degrees, 20 minutes, and Nansen was surprised to find how warm the water was at a great depth. He remarks that on the surface the temperature of the water of the East Greenland current is just about the ordinary freezing point, while usually--at lower latitudes--the water falls as you get below the surface, so that at depths greater than a hundred fathoms it is from one to two Centigrade degrees cooler--but of course it does not freeze owing to the greater pressure and other factors. But here, on the contrary, in 80 degrees instead of from 60 to 70 degrees, he found that the deeper he took soundings the warmer the water was. He did not know where this warm water came from, but we can suspect.

ARCTIC ICE NOT FROM COLD WEATHER

In July, Nansen made a number of observations on the formation of ice and came to the conclusion that the thickness of the arctic ice is not attained by direct freezing as a result of cold weather. Only a little ice is formed at a time, and the great hummocks and floes of which we read are simply formed by the ice packing and mass after mass being frozen up into great aggregates.

SOUNDING THE POLAR SEA

The next job Nansen set himself was deep sea sounding. He had expected the polar seas to be shallow and none of his lead-lines were long enough to touch bottom. So he sacrificed one of the Fram's steel cables, unraveled it, and twisted two of the strands into a lead line of 2700 fathoms in length. With this he touched bottom at depths ranging from 1800 to 2100 fathoms. He says:

"This was a remarkable discovery, for, as I have frequently mentioned, the unknown polar basin has always been supposed to be shallow, with numerous unknown lands and islands. . . ."

From this assumption of a shallow polar sea it was concluded that the regions about the pole had formerly been covered with an extensive tract of land, of which the existing islands are simply the remains. This extensive tract of polar land was furthermore assumed to have been the nursery of many of our animals and plant forms, whence they had found their way to lower latitudes. These conjectures now appear to bear upon a somewhat infirm basis.

The importance of those remarks is obvious. If the Polar sea in these latitudes is not shallow and if the land which is spoken of above never really existed in more extended form than the present islands where was that "nursery of many of our plant and animal forms"? If Nansen had only guessed it was not so very far away from the locality which has been assigned to it. Not the land that these explorers and scientists thought arose out of that shallow Polar sea, but a land just a little further away--the other side of the immense polar aperture.

Meanwhile Nansen kept up his records of temperatures at various depths, and always found that while the temperatures fluctuated at various depths, they rose when very deep water was reached.

NUMEROUS ARCTIC BIRDS

Numbers of birds visited the explorers from early summer on, including ice-mews, kittiwakes, fulmars, blue and herring gulls, black guillemot, skua, and snow-bunting. But these visits were eclipsed in interest by the following, which Nansen tells under date of August 3rd, 1894:

"On August 3rd a remarkable occurrence took place: we were visited by the Arctic ross-gull. I wrote as follows about it in my diary: 'Today my longing has at last been satisfied. I have shot Ross's gull, three specimens in one day. This rare mysterious inhabitant of the unknown north, which is only occassionally seen, and of which no one knows whence it cometh or whither it goeth, which belongs exclusively to the world to which the imagination

aspires, is what, from the first moment I saw these tracts, I had always hoped to discover as my eyes roamed over the lonely plains of ice. And now it came when I was least thinking of it. I was out for a little walk on the ice by the ship, and as I was sitting down by a hummock my eye wandered northward and lit on a bird hovering over the great pressure-mound away to the northwest. At first I took it to be a kittiwake, but soon discovered it rather resembled the skua by its swift flight, sharp wings and pointed tail. When I had got my gun there were two of them together flying round and round the ship. I now got a closer view of them and discovered that they were too light colored to be skuas. They were by no means shy, but continued flying about close to the ship. On going after them on the ice I soon shot one of them (and, was not a little surprised on picking it up, to find it was a little bird about the size of a snipe; the mottled back, too, reminded me also of that bird. Soon after this I shot the other. Later in the day there came another which was also shot.... Some few days afterwards some more of these birds were shot, making eight specimens in all.'"

Is it not a remarkable thing that these ross-gulls should have no known habitat as Nansen points out in the above paragraph? They must live and breed somewhere, and as these specimens--the first two at all events--were actually seen to come from the north it is only reasonable to suppose that they came from that land which we assert is to be found on the other side of the ice barrier, in the interior of the earth.

NANSEN GETS LOST

The observations quoted above, the constant noting by Nansen that the weather is warmer than he had expected, the soundings of the sea, are all important but they are not so important, from the standpoint of making the reader understand Arctic voyaging, as what follows. The following words of Nansen have been picked out of page after page of his journals. And they all refer to one fact: that he could not tell where he was. Before we quote these let us see just what they imply. When we read of Arctic explorers moving from point to point and calculating their whereabouts we are apt to forget that what sounds so simple when expressed on the page--such expressions as "We were now in so many degrees latitude and such and such a longitude"--we are apt to forget that those figures may have been obtained under great

difficulties or guessed at, and that they are often mere approximations. Unknown currents and other factors may make what is known as "dead reckoning" quite useless in the Arctic, and the unusual compass variations and the impossibility at times of making observations of the sun or stars lead the Arctic explorer very far astray. Now if the reader does not bear that in mind he is apt to think that Peary's statement that he actually found the Pole knocks out our theory. But if he does bear that in mind and if he remembers, too, that Peary did not figure on the actual conformation of the polar region as we have pointed it out, he will readily see that Peary was mistaken in his assertion. And, apart entirely from the fact that there is no solid pole to discover, he will see how easily Peary could be wrong by noticing how far wrong Nansen is constantly getting. Only Nansen does not feel any hesitation about admitting it. And the fact that this competent explorer with all the science of navigation at his command has so much difficulty in finding his way around in the polar regions shows how little is really known about them. Suppose that Peary made one such miscalculation as some of these that Nansen confesses to, and suppose that he used that calculation as a basis from which to make others: the error would be multiplied, and Peary might claim to find the Pole or anything else without being able to prove anything as to his exact location.

HE IS QUITE UNABLE TO LOCATE HIMSELF

But here is the sort of thing which is constantly happening to Nansen. In the course of the voyage of the Fram through the Kara Sea in 1893, while they were still as far south as seventy-six degrees, two minutes north latitude: "or about 14 miles from what is marked as the mainland on Nordenskiold's or Bove's map", we find: "It was hardly to be expected that these should be correct, as the weather seems to have been foggy the whole time the explorers were here".

Right there we see two chances for error: foggy weather and the inaccuracy of maps--itself due to previous foggy weather or to any other cause.

Nansen then proceeds:

"Nor were we successful in finding Hovgaard's Islands as we sailed north.

When I supposed that we were off them, just on the north side of the entrance to Taimur Strait, I saw, to my surprise, a high mountain almost directly north of us, which seemed as if it must be on the mainland. What could be the explanation of this? I began to have a growing suspicion that this was a regular labyrinth of islands we had got into. We were hoping to investigate and clear up the matter when thick weather with sleet and rain, most inconveniently came on, and we had to leave this problem for the future to solve."

HE IS STILL LOST

That is just one illustration of the uncertainties of Arctic travel. But it is by no means the only one. Here are a number of others taken from the records which Nansen made after he had proceeded much further north. In February, 1895, Nansen left Sverdrup in charge of the Fram and started out on a northward sledge journey which he hoped would take him to the pole and from there to Spitzbergen by way of Franz Joseph Land. The start was made from latitude 83 degrees, fifty minutes north. Nansen was accompanied by Johansen and had six sledges well equipped, including an instrument which registered the mileage covered. One or two false starts were made, but at last the party got under way and by Friday, March 22nd, had reached a latitude of 8S degrees, 9 minutes north. One very interesting observation which was made at this point was of a "large frozen pool" which looked almost like a large lake. Nansen says "It is wonderful that these pools can form up there at that time of year."

FINDS ICE IS FROM FRESH WATER

It is also noteworthy that the ice over which the party traveled was fresh: Nansen found that it was quite possible to quench the thirst by sucking it. By March 29, we began to get the sort of observation which we promised the reader: the observation which showed that the explorer could not determine his whereabouts. On that date, for instance, Nansen took an observation which showed him to be in latitude 85 degrees, 30 minutes. He says: "I could not understand this; thought that we must be in latitude 86 degrees, and, therefore, supposed there must be something wrong with the observation." Incidentally he also noticed other fresh water pools.

By the time Nansen had reached a latitude of more than 86 degrees he found the temperature rising, and was far more comfortable than he had been further south. By April 14th, Easter Day, Nansen took the opportunity of being halted by lanes to make extensive observations, as he had allowed the watches to run down and wished to calculate the time from his observations. He had also determined not to try to get any further north on that trip and had shaped his course for Cape Fligely. But he was puzzled by his observations. He says:

"I have calculated our previous latitudes and longitudes over again, to see if I can discover any mistake in them. I find that we should yesterday have come farther south than 86 degrees, 5.3 minutes north; but according to our reckoning, assuming that we covered fifty miles during the three days we should have come down to 85 degrees and fifty odd minutes."

NEITHER LATITUDE OR LONGITUDE IS RIGHT

Meanwhile, he was also in doubt about his longitude. He assumed that it was 86 degrees East but adds in a footnote, "I felt convinced that we could not have reached such a westerly longitude, but assumed this for the sake of certainty, as I would rather come down on the east side of Franz Josef Land than on the west side. Should we reach the latitude of Petermann's Land or Prince Rudolf Land without seeing them, I should in the former case be certain that we had them on our west, and could look out for them in that direction, whereas in the event of our not finding land and being uncertain whether we were too far east or too far west, we should not then know in what direction we ought to look for it."

PROOF THE ARCTIC EXPLORATION IS LARGELY GUESS WORK

Nov, we ask the reader if that passage does not prove conclusively that finding one's position in the Arctic region is largely a matter of guess work and approximation and luck? Is it not possible that this difficulty is due to the downward curvature of the earth's surface?

Meanwhile, the explorer had sunshiny, mild and balmy weather. On April

16th, in fact, the sun scorched quite unpleasantly. The tent was pitched in broiling sun, and for days after the atmosphere was equable and stagnant.

WHERE DID THIS FOX COME FROM?

On April 26th, Nansen has something very significant to report:

"I was not a little surprised yesterday morning when I suddenly saw the track of an animal in the snow. It was that of a fox, came about W. S. W. true, and went in an easterly direction. The trail was quite fresh. What in the world was the fox doing up here? There were also unequivocal signs that it had not been without food. Were we in the vicinity of land? I looked around for it, but the weather was thick all day yesterday, and we might have been near it without seeing it. In any case, a warm-blooded mammal in the eighty-fifth parallel. We had not gone far before we came across another fox-track; it went in about the same direction as the other, and followed the trend of the lane which had stopped us and by which we had been obliged to camp. It is incomprehensible what these animals live on up here, but presumably they are able to snap up some crustaceans in the open water ways. But why do they leave the coasts? That is what puzzles me most. Can they have gone astray? There seems little probability of that."

Well, this is not the first animal whose presence in the remote Arctic has startled explorers, and as we shall see it is by no means the last. They are so abundant in those supposedly bleak and inhospitable regions that there is only one possible explanation of their presence: they must come from the interior. They could not possibly have come from the south for, as we have seen it is further south than where they have been found that the Arctic explorer finds most of his difficulties. No, these animals and birds have their homes and breeding places in the interior of the earth, near the polar orifice, and it is from there they come and thither do they go. Have we not the explorers' testimony time after time that these animals and birds have actually been seen on their way north?

NANSEN CAN HARDLY SLEEP FOR HEAT

On May 4th, the explorer is again found commenting on the mild weather. One night, he says, he could hardly sleep for heat. In the day time he can lie

in the tent basking in the heat from the sun. "Last night," runs another entry, "it was almost too warm to sleep".

About May 19th, Nansen is again off his bearings:

"We can hardly be far from 83 degrees, 10 minutes, North, and should have gained Petermann's Land if it be where Payer supposed. Either we must be unconscionably out of our bearings, or the country very small. Meanwhile, I suppose, the east wind is driving us westward, out to sea, in the direction of Spitzbergen. Heaven alone knows what the velocity of the drift may be here."

A few days later he writes:

"We ought to have latitude 83 degrees behind us, but as yet no sight of land. This is becoming rather exciting."

On May 27th he writes:

"We are in latitude 82 degrees, 30 minutes, North, perhaps even a minute or two farther south. But it is growing more and more remarkable that we see no sign of land. I cannot explain it in any other way than that we are some degrees farther east than. we suppose."

By May 31st we find him saying "It is impossible that we can have far to go now." But there is "still no glimpse of land; this is becoming more and more of an enigma."

CONFESSES LOCATION IS A RIDDLE TO HIM

On June 5th, he has still the same story to tell. He wishes for a "final solution of this riddle which is constantly before me". But by June 11th there is still no sign of land and Nansen says, "We do not know where we are, and we do not know when this will end."

A few days later he says: "I have calculated and calculated and thought and thought, but can find no mistake of any importance, and the whole thing is a riddle to me. I am beginning seriously to doubt that we may be too far west after all. I simply cannot conceive that we are too far east."

On July 19th Nansen notes the large number of Ross's gulls, which strike

his attention as he cannot imagine where they can come from. He is still completely lost.

LAND, BUT WHAT LAND?

It is only on July 24th that he catches his first glimpse of land, which he had really seen a little time before but had mistaken for clouds on the horizon. The two explorers made incredibly slow progress in their attempt to reach it. After traveling day after day and having to fight a bear that had followed them, they actually reached it early in August. After traveling on the land for a few days, Nansen makes this startling entry:

"This land grows more of a problem, and I am more than ever at a loss to know where we are."

Certainly, one would think that even if the explorer were lost as long as he was on the ice he would instantly find his bearings when he reached solid and permanent land. But as a matter of fact Nansen admits that he does not know even whether he is on the west coast of the archipelago of Franz Josef Land or whether he has fetched up on some other coast altogether. He keeps on going, however, and a few days later writes:

INCOMPREHENSIBLE

"Where we are is becoming more and more incomprehensible. There appears to be a broad sound west of us, but what is it? . . . . . .

"We must have come to a new land in the western part of Franz Josef Land or Archipelago, and so far west that we had seen nothing of the countries discovered by Payer, but so far west that we had not even seen anything of Oscar's Land, which ought to be situated in 82 degrees, North, and 52 degrees East." This was, indeed, incomprehensible, but was there any other explanation?

A few days later Nansen notices that red snow on the glaciers which has been such a puzzle to explorers but which can only come from the interior of the earth.

It may sound incredible, but in February, 1896, Nansen and Johansen have

still not succeeded in discovering their whereabouts. They were speculating about getting home, and as to whether the Fram would reach Norway before them, and Nansen writes:

MUST BE A HITHERTO UNKNOWN LAND

"But where were we? And how great was the distance we had to travel? Over and over again I reckoned out our observations of the autumn and summer and spring, but the whole matter was a perpetual puzzle. It seemed clear, indeed, that we must be lying somewhere far to the west, perhaps off the west coast of Franz Josef Land, a little north of Cape Lofley, as I had conjectured in the autumn. But, if that were so, what could be the lands which we had seen to the northward? And what was the land to which we had first come? From the first group of islands which I had called White Land to where we now lie, we had passed about 7 degrees of longitude--that our observations proved conclusively. But if we were now in the longitude of Cape Fligely, these islands must lie on a meridian so far east that it must fall between King Oscar's Land and Crown Prince Rudolf Land; and yet, we had been much farther east and had seen nothing of these lands. How was this to be explained? . . . . No, we could not have been near any known land. . . . There were other things, too, that greatly puzzled me. If we were on a new land near Spitzbergen, why were the ross-gulls never seen there, while we had found them in flocks here to the north? And then there was the great variation of the compass. . The whole thing was, and remained, an insoluble riddle."

The reader will at once see how the question of the presence of the ross-gulls only added to Nansen's perplexity, as he could not know of the real facts: that these gulls were seen to the north because they came from the north. And the extreme variation of the compass in the arctic regions is not due to the fact that the magnetic pole does not coincide with the north pole, but is due to the peculiar conformation of the region. In calculating the magnetic pole's position, geographers have not allowed for the actual shape of the earth at the polar regions. But that is a matter which belongs in another chapter.

How Nansen gradually made his way south until he came to land that he knew and found his way to Cape Flora, where he met white men, does not

concern us here. Suffice it to say that he could not even then discover, with all the maps at his disposal, just where he had spent the previous summer and winter. He says:

PAYER'S MAP DOES NOT HELP

"Much of Payer's map I found to coincide well enough with our own observations. But the enigma over which we had pondered the whole winter still remained unsolved. Where was Dove Glacier and the whole of Wilczek Land? 'Where were the is-lands which Payer had named Braun Island, Hoffmann Island, and Freden Island? The last might, no doubt have been identified with the southernmost island of White Land but the others had completely disappeared. I pondered for a long time over the question how such a mistake could have crept into a map by such a man as Payer--an experienced topographer, whose maps, as a rule, bear the stamp of great accuracy and care, and a polar traveler for whose ability I have always entertained a high respect".

WHAT NANSEN'S EXPERIENCE PROVES

No further argument ought to be necessary to convince the reader that the polar regions are not as well known as we are given to suppose. Here is Nansen admitting that even with the maps before him, he cannot identify the mysterious land which he found after making a sledge voyage in which he did not once know just what his bearings were. And here is his pronouncement that lands which were definitely marked on the map of one of the best known explorers and a man used to map making simply did not exist. Surely from those significant facts the reader can draw his own conclusion: that the statements of Arctic travelers relative to reaching the pole and discovering this land or that land, must be taken with a great deal of reserve. When in the near future an æroplane or dirigible shall actually travel over all these regions, the observers thereon will see much that no Arctic explorer has ever told us about, and they will fail to see some things which Arctic explorers have claimed they found. Such observers will see the great barrier of northern ice come to an end at the edge of a great polar ocean, and they will sail high over that ocean until they see, even though it be in the midst of the Arctic winter, a sun that is shining all the time. And then they will know

that they have followed the curve of that great ocean surface as it dipped out of sight of our horizon and began to wash the shores of the inner surface of the world, a surface divided even as the outer one is, into land and water, both steeped in perpetual but cloud-engirt sunshine, and both the abode of animal and vegetable life. There will be found the home of the ross-gull and the haunt of Arctic bear and fox. And beyond that polar orifice they will not only find those animals roaming and breeding, but they may see the mammoth alive there that is so often found dead in the Siberian ice. But to that immense animal, long thought extinct, we shall devote a later chapter.

CHAPTER IX. WAS THE NORTH POLE DISCOVERED?

Some people have said that they would consider our theory triumphantly demonstrated if it were not for the fact that the North Pole had actually been discovered. What we have already said about the difficulty of finding one's way about in the Arctic--and the same applies to the Antarctic--would suffice to cast some doubt upon the feat, but as the point is such an important one we will consider it in further detail, and show that neither Peary nor Cook was able to prove that he had reached the pole and that the scientific societies which considered their claims especially the committee of his fellow countrymen who examined Peary's proofs--agreed that in neither case could it be said authoritatively that the explorer had reached the pole.

THE FIRST CLAIM TO THE POLE

The first claim, of course, was made by Dr. Frederick A. Cook, who announced that he had reached the North Pole on April 21, 1908. Then, within a few days of this announcement and the general acceptance of Cook's claim by the world although there were a few dissenting voices there came a despatch from Peary to the effect that he had discovered the Pole, reaching it, as he claimed, on April 6, 1909, nearly a year after Cook's alleged discovery.

As Cook was the first to make the claim we will consider his claim first, noting, however that the difficulties of making proper observations, owing to the fact that in April the sun was only a few degrees above the horizon, applied to Peary as well as to Cook. Both were in a position where it was impossible to make very accurate observations.

PEARY'S RIVALRY

The general acceptance of Cook's claim was based on his prediction that he could establish by field notes and mathematical observations the truth of his claim. But on one excuse or another he never did produce all the notes he said he would. He claimed that Peary caused some of this data to be buried,

which may be true. But at any rate it was not long before the first faith in Cook was succeeded by a very general skepticism. This skepticism may have been started by Peary's denial of Cook's claim, a denial which was made promptly and vigorously in no uncertain or diplomatic language. But it was undoubtedly fed by Cook's own policy of not giving the world proper scientific data. In fact Peary's sharp way of criticising Cook and the facts which soon after came out tending to show that Peary thought he owned both the polar regions and the Eskimos, and that he had taken some of the stores which Cook had cached pending his return from the north--all that created a great prejudice against Peary, and Cook seemed to have things all his own way. But he never submitted real proofs.

MELVILLE IS SKEPTICAL

And his despatches about the pole did not sound convincing to men who knew of conditions in the north. Rear-Admiral Melville, of the United States Navy, himself an old time arctic explorer said in an interview:

"It was the crazy despatches purporting to have come from Dr. Cook about the conditions he found there, and other things, that caused a doubt in my mind about Cook's having found the pole."

The London Daily Mail said:

"The long message in which Cook recounted his journey was by general consent pronounced unconvincing, and the further particulars which he communicated since landing at Copenhagen have not removed all ground for doubt. . . . . A large section of the public still entertains doubts and asks why it is he has not brought with him his journal and detailed observations to establish the truth of his statements."

TITTMAN'S REMARKS LEAD DIRECTLY TO OUR THEORY

Dr. George Tittman, head of the coast and geodetic survey at Washington was asked if Cook's claim to have been at the pole could be checked up by comparing it with what scientists knew would be the conditions at that spot. His answer was in itself almost an admission that the time was ripe for our

own theory to be given to the world. For what he did was to acknowledge the bankruptcy of science when it came to having knowledge of that region. He said:

"There are really no scientific theories as to what is immediately around the pole. There are some theorists who think that there is an open sea and some who think that a fertile spot is there. Scientific men are inclined to think that there may be little difference in immediate conditions close to the pole from those in the Arctic regions miles from there."

That is really a remarkable admission from a scientist. For, if the orthodox scientific idea about the polar regions is right, it ought to be colder there than anywhere else. And yet Dr. Tittman admits that practically all scientists agree that this is not the fact. Some, he says, think there is an open sea there and others say there is fertile land. We can see why some of them think there is open sea there because, as we have already seen, all explorers who have gone far enough north have found an open sea. But why should any scientists think there is fertile land at the pole? It seems impossible on their own theories of a solid earth with increasing cold as you go north. Even if the cold at the poles was not enough to freeze the sea up, how could it be warm enough to produce fertility? The answer is, that the scientists who say that are simply men who are honest enough to follow all the evidence. They have seen the evidence already cited in this book of animal life and vegetation in the north, but they had no idea of our theory which alone explains that life. But they went as far as they could. It is the scientists who have gone that far already, who try to find room in the north for fertile land as the only explanation of the facts which we have already cited--it is these scientists, we say, who will be the first to give their adherence to our theory. For it alone gives a logical explanation of the facts which they admit but cannot explain.

But at any rate, Dr. Tittman had no light to throw on Cook's claim except insofar as Cook reported neither open water nor fertile land, and in view of the unanimous discovery by explorers of open water in the regions of the polar orifice, it is very clear that Cook did not go as far north as he thought he went.

THE ACADEMY DESERTS COOK

And as a matter of fact when the Swedish Academy of Sciences and University of Copenhagen went over his alleged proofs they decided that he had not proved that he reached the pole. Of course, they were not in a position to state positively that he had not reached the pole, and Cook made much of the fact that their verdict was what he called "neutral". But the fact remains that they did not support him.

And finally, we may note that in the book which Cook wrote to substantiate his claims, the book which he said would contain his case for the public's judgment, his final word, he himself admitted that he did not actually reach what is usually called the pole, but only approximated it. He says:

COOK ADMITS HE DID NOT GET THERE

"Did I actually reach the North Pole? When I returned to civilization and reported that the boreal center had been attained, I believed that I had reached the spot toward which valiant men had strained for more than three hundred years. . . . . If I was mistaken in approximately placing my feet upon the pin-point about which this controversy has raged, I maintain that it is the inevitable mistake any man must make. To touch that spot would be an accident. . . . . Mr. Peary's case rests upon three observations of sun altitude so low that, as proof of a position, they are worthless."

PEARY'S PROOF WORTHLESS

We may now glance at the sort of proof that Peary brought forward to substantiate his claim. In the first place, it is notable that he did not lose a minute in trying to discredit Cook. He had no sooner reached Labrador than he telegraphed home as follows:

"Cook was not at the North Pole on April 21, 1908, or at any other time. This statement is made advisedly."

"Delayed by gale. Don't worry about Cook. Eskimos say Cook never left sight of land. Tribe confirms."

And to the Associated Press he wired:

"Cook's story should not be taken too seriously. The two Eskimos who

accompanied him say he went no distance north, and not out of sight of land. Other members of the tribe commemorate their story."

And later:

"Do not trouble about Cook's story or attempt to explain any discrepancies in his statements. The affair will settle itself.

"He has not been at the pole on April 21st or any other time. He has simply handed the public a gold brick.

"These statements are made advisedly and I have proof of them. When he makes a full statement of his journey over his signature to some geographical society or other reputable body, if that statement contains the claim that he has reached the pole, I shall be in a position to furnish material that may prove distinctly interesting reading for the public.

"ROBERT E. PEARY."

PEARY ALSO LACKED WITNESSES

Of course one trouble with Cook's claim was that he had no witnesses of his deeds. The testimony of the Eskimos was worthless for they knew nothing about making observations. But what was the surprise of the public to learn soon after this that Peary had no witnesses either.

In that interesting and very fair book on the subject of the polar controversy, "The Discovery of the North Pole," being both Cook's and Peary's stories with an introduction by General Greely, edited by the Honorable J. Martin Miller, the editor says:

"Like Cook, Peary stood practically alone amid the desolation of 'farthest north'. Cook had with him two Eskimos who, as described by him, were panic-stricken and prayed to their deity. They were in no sense sharers of the emotion of their white master. And so it was with Peary, with the difference that his colored personal attendant was there to witness the triumph. One Eskimo--who was there--Egingwah by name--no doubt, looked on rather cynically at Peary's deeds . . . . . .

"That Peary sent back all his white companions and pushed on alone to the

pole caused a little surprise when first it became known. Yet it was recognized as just that the leader and inspirer of it should have all the glory. His were the risks; then why not his the honor? So, with bitter disappointment, perhaps, yet with unquestioning obedience to orders, the faithful companions of Peary stopped, one by one, within a few days' march of the pole and let him go ahead with his one swarthy companion."

Now we cannot share the editor's sympathy with Peary in this matter. Not only had his companions shared his risks and thereby earned a part in the glory, but if Peary were not generous enough to acknowledge that, he ought to have seen the value of their corroborative evidence of his achievement. If Cook merely camped around for a few days barely out of reach of land, and then came back with a big claim, what was to prevent Peary simply going on a few miles ahead of his companions and then making a few observations, with nobody to verify them or check them up, and then come back and make any announcement he pleased?

Then Peary came back to civilization and it was found that several things about Cook's story which made it sound dubious were equally characteristic of Peary's story. He had taken even fewer observations of his alleged position at the Pole than Cook had done. Where Cook was doubted when he said he made fifteen miles a day in sledge traveling, Peary claimed to have made over twenty. As the Honorable Mr. Miller says:

"Peary was the only white man in his party to reach the pole He alone made observations and reckonings at the pole. None of the men with him knew anything about determining latitudes or longitudes.

They could not have known they had reached the pole unless Peary told them. Like Cook, Peary brought back practically his own word alone to support his claim that he had attained the earth's apex.

PEARY'S FIGURES SELF-CONTRADICTING

"When we come to rate of travel, Cook's fifteen miles a day seems modest in comparison with the distance Peary covered. When near the eighty-eighth parallel, Peary decided to attempt to reach the pole in five days' marches. According to his story, he made twenty-five miles on the first day, twenty on

the second, twenty on the third, twenty-five on the fourth and forty yes, forty on the fifth. On these last five days he traveled at an average rate of twenty-six miles a day.

"And on the return trip from the pole to Cape Columbia he made even better time. He tried, he says, on the return trip, to make double the distance he covered on his dash to the pole. 'As a matter of fact,' he declares, 'we nearly did this, covering regularly on our return journey five outward marches in three return marches.'

"It is easy to figure out the average rate of speed he made on his return trip. He started back from the pole, he says, on April 7th and reached Cape Columbia on April 23, covering the 450 miles in sixteen days. This is a daily rate of 28.12 miles a day.

"Will the Arctic experts who declared it impossible for Cook to make fifteen miles a day charge Peary with falsehood when he says he made forty?"

One day, it will be remembered Peary actually claims to have made forty miles. Any reader who has been on a walking tour and knows what it is to walk forty miles a day on good roads with an inn to rest in at times, can tell what that would mean. Here was Peary, with his dogs to look after, his camp to make at night, his observations to make, his cooking to do, and certainly some repair work occasionally, making from twenty to forty miles a day. Oh but, the reader may exclaim, the dogs carried him along much faster than walking. But as a matter of fact they did not. Peary admitted that his pace was slower than walking--only he admitted it when he was not thinking of the bearing of the admission. It was when the newspaper men were interviewing him in Labrador. One of them, who did not know much about Arctic traveling asked:

"Did you ride?"

"Ride?" inquired the undaunted Peary, astonished. "Sir, in Arctic expeditions a man is lucky if he is able to walk without pushing his sledge. Usually he may grip the rear and thrust it ahead. It is like guiding a breaking plow drawn by oxen. You must also expect at any moment that the sledge may strike some pressure ridge that will wrench you off your feet."

So it comes to this: that in order to reach the so: called north pole a man must be able to do something as arduous as--and quite similar to--pushing a breaking plow drawn by oxen through arctic ice at speeds varying from twenty to forty miles a day, and keep it up for eight days, after doing almost equally arduous work for months.

MILLER THINKS QUESTION INSOLUBLE

Is it any wonder that the Honorable Mr. Miller, after giving all this data sadly concludes that:

"The question whether Cook or Peary discovered the North Pole may never be solved. It bids fair to become one of history's conundrums, and to remain a matter of one man's word against another."

But after all, Mr. Miller, if there is no pole to be discovered it is obvious that neither of your two heroes discovered it. The question will become relatively unimportant when we state it in its real form: Which of these men got furthest north? Surely that will not matter so much when we really explore the polar regions and find that what each man was after was simply a myth.

Now any doubt that we have thrown upon Peary's achievements by our words above is not a doubt raised by us alone. When Peary came to submit his proofs to investigation, the committee that went into the matter, afterwards acknowledged in congress that Peary had not, any more than Cook, proved his point.

PEARY'S OWN QUOTATIONS SHOW HIM UP

How far he was from being able to prove it we may see by comparing some of his own statements. The following quotations were taken from Mr. Peary's own book, "The North Pole: Its Discovery, 1909". We reproduce both the quotations and some comments that were made on them at the time the book was published:

"'We turned our backs upon the pole at about four o'clock of the afternoon of April 7th.'

"According to a statement made on page 304, Mr. Peary took time on his return trip to make a sounding of the sea five miles from the pole.

"On page 305 Mr. Peary says: 'Friday, April 9th, was a mild day. All day long the wind blew strong from the north-northeast, increasing finally to a gale.' And on page 306, 'We camped that night at eighty-seven degrees, forty-seven minutes.'

"Mr. Peary thus claims to have traveled from the pole to this point, a distance of 133 nautical miles, or 153 statute miles, in a little over two days. This would average 76.5 statute miles a day. Could a pedestrian make such speed? During this time Mr. Peary camped twice, to make tea, eat lunch, feed the dogs, and rest--several hours in each camp.

"On page 310 Mr. Peary says: 'We were coming down from the North Pole hill in fine shape now, and another double march, April 16-17, brought us to our eleventh upward camp at eighty-five degrees, eight minutes, one hundred and twenty miles from Cape Columbia.'

"According to this, Mr. Peary covered the distance from eighty-seven degrees, forty-seven minutes, on April 9th, to eighty-five degrees, eight minutes, on April 17 a distance of 149 nautical miles in eight days. This averaged twenty miles a day.

"On page 316 he says: 'It was almost exactly six o'clock on the morning of April 23rd when we reached the igloo of Crane City at Cape Columbia and the work was done'.

"Mr. Peary left eighty-five degrees, eight minutes, on April 17th, according to his statement, and travelled 120 miles to Cape Columbia in six days, arriving on April 23rd. This last stretch was at the rate of twenty miles a day. To sum up he traveled from the North Pole according to his statements, to land, as follows:

"The first 133 nautical miles southward in two days, at the rate of 66 nautical miles, or 76.5 statute miles, a day; the last 279 nautical miles in fourteen days, an average of twenty miles a day.

"According to Peary's book, Bartlett left him at eighty-seven degrees, forty-six minutes, and Mr. Peary started on his final spurt to the pole, a little

after midnight on the morning of April 2nd. By arriving at the point where he left Bartlett on the evening of April 9th, he would have made the distance of 270 miles to the pole from this point and back, in a little over seven days."

MATHEW HENSON'S STATEMENTS

"In the *New York World*, of October 3rd, 1910, page 3, column 6, Mathew Henson makes the following statement: 'On the way up we had to break a trail, and averaged only eighteen to twenty miles a day. On the way back we had our own trail to within one hundred miles of land, and then Captain Bartlett's trail. We made from twenty to forty miles a day.'

"At the rate of twenty miles a day on the way up, which Henson claims was made, it would have taken six days of twenty-four and eighteen hours to cover the distance of 13S miles from eighty-seven degrees, forty-seven minutes, to the pole. Adding the thirty hours Mr. Peary claims he spent at the pole for observations, eight days would have elapsed before they started back. Peary says the round trip of 270 miles from eighty-seven degrees, forty-seven minutes North to the pole, and the return to the same latitude, was done in seven days and a few hours.

"Why has Mr. Peary never been asked to explain his miraculous speed, and the discrepancy between his statement and Henson's?"

CONGRESS IN A DILEMMA

Well one may answer that by saying that as the Cook business had created one great international scandal, neither the authorities at Washington nor the American press were anxious to have another. One American had claimed that he had reached the pole. Foreign kings and princes had congratulated him, foreign universities had showered honors on him, only to find out afterward that there was a great probability that they had been duped. If, following that, another American, an officer in the navy, had made a similar claim and that claim had been proved fraudulent, this country would not only have been the laughing-stock of the world but our national honor had been tarnished. Every American after that would have been regarded with suspicion. American scientists would be distressed. The United States would have been placed in an intolerable situation. Other nations would have

pointed the finger of scorn at us, and our prestige would have been lowered all over the world.

INVESTIGATIONS A YEAR LATER

No, Congress could not afford to make any public statement that Peary had played false or that he had even been honestly mistaken in his claim, for even a "mistake" would have been made a matter of ridicule in the foreign press. So what was actually done? First a committee of the National Geographical Society was formed which rendered a favorable verdict after a cursory examination of Peary's field notes, and it was hoped that nothing more would happen. But something did happen. That verdict was challenged on the floor of Congress. A congressional investigation was held a year later--when the clamor had died down--and its verdict was that Peary's proofs did not prove; that his achievement rested wholly upon his assertion--an assertion not backed up by a single white witness.

And the end of the story is just as significant. Great efforts were made by various parties to have the whole matter threshed out, following the verdict of "not proven" by the Congressional committee. But Congress and the government were afraid to act. Peary, significantly enough, never asked for an investigation and never replied to some very damaging charges brought against him not only by Cook but by independent societies. It was known that he wished to end his career after the polar exploit by retiring with the rank of Rear-Admiral--which carried a pension with it of $6,000. Friends of Peary brought into Congress, a bill so retiring him. One would think that before such a reward was granted the charges would be pressed and Peary's claimed finding of the pole confirmed. But such was not to be. No inquiry was ordered. It is interesting to note that Professor Moore, president of the National Geographical society which was financially interested in Peary's exploits, was one of the most active men in lobbying for this bill, and that he has since been dismissed from his position in the government service.

SUMMING UP THE LESSON OF THIS CONTROVERSY

And what is the significant end to this story? It is that although the bill was signed it was changed before the signing took place, and the false

assumption of Peary's "Discovery of the Pole" was stricken out. That means that the government officially re-fused to endorse Peary although it could not afford to accuse him of anything that would lower us in the eyes of the world.

And there the matter rests. Neither Peary nor Cook has been able to prove that he reached the pole. Owing to the notorious difficulty of finding one's way around in a neighborhood where observations from the sun are not possible in winter--and the sun was barely above the horizon when both explorers were there--where distances are deceptive, where the compass is useless, where even Nansen admits he was absolutely lost--owing to all these difficulties we must not be astonished at the failure of these two men to find out where they really were. We need not even impute to them bad faith; both may have been honest in their claims although Peary's attacks on Cook and his failure to answer Cook's charges do reflect on him. But we cannot help noticing the difference in the reports of Arctic conditions which these two men make and those made by all previous explorers. Every previous investigator, who got really far north, found out the truth about the open polar sea and the rise of temperature as he neared the pole. The case for those two truths is bullet proof. Only Peary and Cook failed to see those two great facts, and in that failure we read the truth of their journeys--that they were not in the neighbor-hood of the polar orifice but at points further south than that. Had they gone further they would have found open water and increasing temperatures. Had they then possessed boats they could have launched on that sea and the way to the goal and to the truth would have been clear. They would have seen the earth's central sun shining even in the winter, shining all of the twenty-four hours and all of the year, and they would have discovered new continents and oceans, a new world of land and water and of forms of life some of which have vanished from the outside of the globe.

But it was not to be. The discovery of that new land was left to those who, following the theory out-lined in this book, and using such safe means of Arctic traveling as the aeroplane or dirigible, will fly over the eternal barrier of ice to the warmer sea beyond and over that until they come into the realm of perpetual sunlight.

AMUNDSEN IN THE ARCTIC REGIONS

Since the above was written there have appeared despatches in the

newspapers from Nome and Copenhagen to the effect that Captain Roald Amundsen is making an attempt to reach what is generally known as the North Pole. As Amundsen thinks he discovered the "South Pole" it will be very interesting to watch his progress in the north. Quite probable he may discover the polar opening and thereby prove that he did not discover the South Pole.

According to these despatches, Captain Amundsen was on the shore of the Bering Sea, at a Russian trading post called Anadir, late in April. Details were not forthcoming. Captain Bartlett, who commanded the Roosevelt on Peary's expedition, thinks the fact that Amundsen has come to that point means that something has gone wrong with his plans. Meanwhile Captain Ejnar, an Arctic explorer, takes issue with what Nansen has said about Amundsen's expedition, namely, that it is possible for him to reach his objective--the so-called pole--by drifting with the ice from Point Barrow. Captain Nikkelson thinks that Amundsen has either given up his attempt or has come to this trading post to get new supplies in order that he may make another attempt. The latter would seem to us to be the true explanation, as Amundsen is a persevering explorer, and after his experiences in the Antarctic, it is not likely that he would fail in his northern explorations. So the polar opening may be discovered sooner that most people expect.

To Amundsen may go the credit of being the first man to verify our theory--supposing that he has the proper equipment which certainly ought to include some form of aeroplane.

CHAPTER X. TWO CONGRESSIONAL OPINIONS ON PEARY AND COOK

To back up what we have just said of the claims of Messrs. Peary and Cook to have discovered the poles, let us briefly quote from two members of the United States House of Representatives on the claims of these men. These remarks were made by capable thinkers after earnest study of the question and they ought to have a good deal of weight. Their speeches were reprinted in the Chicago Examiner, September 24th, 1916.

HELGESEN ROASTS PEARY

The Honorable Henry T. Helgesen, representative from North Dakota, said:

"I am satisfied that Peary did not discover the pole, for two reasons:

"1. For all the talk there has been about scientific data brought back by him and furnished as evidence, the fact is that his claim to the discovery in question is backed by his unsupported word, and by nothing else.

ALL OTHER PEARY CLAIMS DISPROVED

"2. All of the other claims to discoveries in the Arctic regions by Peary have been proven false. Why, then, should we accept as true his unsupported statement that he arrived at the pole?

"So much for my reasons for believing that Peary did not reach the pole. Now it remains for me to prove that these reasons are based on facts, and not on mistakes or personal prejudices.

"Peary claims to have discovered the Peary Channel--an alleged northern boundary of Greenland--and, therefore, to have been first to establish the fact that Greenland is an island.

"That discovery alone, if a true one, would be sufficient to establish for Peary a reputation as an explorer. But, unfortunately for him, it has been

proved by explorations subsequent to his that no such channel exists.

"The Peary discovery of the channel was made incidentally to his expedition of 1901-1902. Five years later the Danish explorer, Mylius Erichsen, looked in vain for this interesting geographical feature.

"In 1912 the denial of its existence was verified by another explorer, Knud Rasmussen, who reported that he found, where the channel was alleged by Peary to be, no water at all, but 'an ice-free upland, abounding in game'.

PEARY "DISCOVERIES" ERASED FROM MAPS

"In view of this and other evidence, Peary Channel has been struck off the maps of our navy Department and off the charts of the Coast Survey.

"The Peary Channel was alleged to open at one end into a great body of water, which Peary called the East Greenland Sea. This sea was mapped by Peary in 1901-1902 as extending from 82 degrees, ten minutes north latitude and 31 degrees west longitude to about 12 degrees west longitude. Here, undeniably was another and very important geographical discovery. But again, unfortunately, the Mylius Erichsen expedition, five years later, ascertained definitely that the vast water-space in question was, all of it, dry land.

"This was verified by the later expeditions of Mikkelsen and Rasmussen. Consequently the East Greenland Sea has been removed from our Government maps.

"But the Navy Department charts of the Arctic still show, to the northwest of Grant Land, an undefined land mass named Crocker Land, which Peary claims to have discovered in 1906. To geographers, Crocker Land offered an obvious and tempting invitation; and, accordingly, in 1913, an expedition was sent out by the American Museum of Natural History to explore it. The expedition got back not long ago, with the report that 'there was no such place'. The site of the alleged Crocker Land was wholly occupied by a broad expanse of polar sea.

"So Crocker Land, like other Peary discoveries, must vanish from the Government and other maps.

"In 1900, Captain Otto Sverdrup, a Norwegian explorer, discovered a big island off the coast of Greenland which he mapped under the name of Axel Heiberg Land. Subsequently, Peary declared that he had 'seen it first' two years earlier, and gave it the name of Jesup Land. It was put down that way on our government maps.

"Peary, in his book, 'Nearest the Pole', published in 1907, says (page 202) that in July, 1898, he saw this land mass from 'the heights of the Ellesmere Land ice-cap.'

"This statement is really rather remarkable; for on pages 296-297 of the same book, Peary says that he spent all the time from July 4th to August 13th of that year in making the trip from New York to Cape York, and in 'hunting walruses and assembling my party of natives' in the immediate neighborhood of the latter place.

"He was thus simultaneously in two places separated from each other by 300 miles. But, even though gifted with supernatural vision, he could hardly have seen Axel Heiberg Land (alias Jesup Land) where he locates it descriptively, because it is much further south and a good deal farther west.

"Evidence in this case being deemed ample, the Government maps and the maps of the National Geographical Society have eliminated Jesup Land and have put Axel Reiberg Land in quite another place, the Geographical Society giving Sverdrup full credit for the discovery.

"Peary Channel being proved a myth it follows that Peary is wrongly credited with having discovered that Greenland is an island. Undoubtedly, Greenland is an island. The fact, however, was not proved by Peary. It was satisfactorily determined by the Greely expedition of 1882--ten years before Peary.

"Inasmuch as Peary's other so-called discoveries have, each and every one been disproved, how can his latest claim to the discovery of the Pole be accepted on his unsupported word, which is all he has to back him up?

"Peary himself says that an explorer's proof must fundamentally be based upon his past record. But what has been Peary's record? . . . . .

"Certainly he has offered no proof. Two secretaries of the Navy, (the

service in which he was employed), have said that they have never received any data from Peary to substantiate his statement that he reached the Pole.

PEARY'S MISSING DATA

"Peary claimed that all his data were given to the Coast Survey.

"The only proofs received from Peary by the Coast Survey were a set of tidal observations all made at coast points and none of them made on the sledge expedition en route to or returning from the place Peary chose to call the Pole. In addition to these there was only a set of alleged soundings, respecting which the story he tells is so contradictory as to discredit them *prima facie*.

"At a Congressional 'hearing', Mr. Tittman, then Superintendent of the Coast Survey was asked: 'What evidence is there that this party consisting of Peary and others, reached within striking distance of the Pole?'

TITTMAN WILL NOT SUPPORT PEARY

"Mr. Tittman replied: 'I have no evidence of that, except the line of soundings under Peary's signature'.

"Peary brought back nothing--no witnesses, no worthwhile scientific proof, nothing but his unsupported word to back up his claim to have discovered the pole. But, inasmuch as his reputation for veracity has been completely shattered by the fact that every other claim of discovery made by him has proven false, there is nothing that the world can accept as demonstrating that at any time he has been anywhere near the Pole."

FESS ROASTS COOK

And here is what the Honorable S. D. Fess, representative from Ohio has to say about Cook's claim:

"It is well for us to remember that the forum selected by Dr. Cook for the determination of his claims was the University of Copenhagen. He sent it what he declared were his proofs of his alleged discovery of the North Pole.

"The committee's final verdict and the verdict of the university consistory is expressed formally in the finding of the latter:

"'The documents handed the university for examination do not contain observations and information which can be regarded as proof that Dr. Cook reached the North Pole on his recent expedition.'

"Rasmussen, a noted Arctic explorer, who has favored Dr. Cook's claim, was called in as an expert by the university's committee; he is reported as saying:

"'When I saw the observations I realized that it was a scandal. The documents which Dr. Cook sent to the university are most impudent. It is the most childish sort of attempt at cheating.'"

DEMOLISHING HIS CLAIMS

And the Congressman quotes other authorities to the same effect and reviews Cook's methods, both in other matters and after he had returned from the north. But we do not need to follow him into those details. We have quoted enough already to serve the purpose of showing that the skepticism which we expressed in the last chapter about the claims of Peary and Cook is fully justified and held generally by intelligent men who have looked into the matter.

The above was written some months before the death of Rear-Admiral Peary, and had it been writ-ten either after his death or while he was in danger of death its controversial tone might have been modified in deference to the man. For it is not the personality of Peary which we are discussing but the scientific results of his voyages. He was a brave man, a devoted scientist, and an explorer of the first rank. Dedicating himself to Arctic exploration at an early age, making dash after dash to the far northern regions as well as many quite successful surveying and mapping trips during which the actual discovery of the so-called pole was not his objective, his whole life is an example of which his countrymen may well be proud. That he worked on a theory of the polar regions which this book shows to be false, is not to his discredit. He had to take the data and deductions of science as he found them. His job was not to theorize so much as it was to explore. This he did to the

best of his ability--and that ability was great. If we have seemed in the foregoing pages to impugn his results we would here stress the fact that we regard him not in any way as an untrustworthy witness but simply as the victim of a false idea of the nature of the earth. Had he worked in the light of our theory his results would have been different. To say, as we have said in the preceding pages, that his observations and reports are self-contradictory is not to dishonor Peary. Does not Nansen also say the same thing of his observations? As long as we have Nansen's own confession that he could not find his way, had no idea where he was, and actually found that his observations were quite out of keeping with the facts--as long as we have this confession from Nansen there is certainly no imputation of either incompetence or dishonesty in saying that Peary was likewise misled.

We say this in justice to the memory of a brave man who, had he lived, would have undoubtedly been one of the fairest-minded critics of our own theory and who would have been the first to take an interest in any attempt to place it among the certainties of science by the method of actual exploration.

CHAPTER XI. THE MAMMOTH

This is not the longest chapter in this book, but to anyone who wishes to prove our theory "in a hurry" it may be commended, for it brings proof to bear so startling, so incontrovertible, that we wonder how these observations could have been made by the regular scientists and their significance been overlooked. But then the regular scientists had a theory of the earth's composition in their minds before they made these observations. And the theory being there first would not budge to make room for the truth.

FROM WHERE DOES THE MAMMOTH COME?

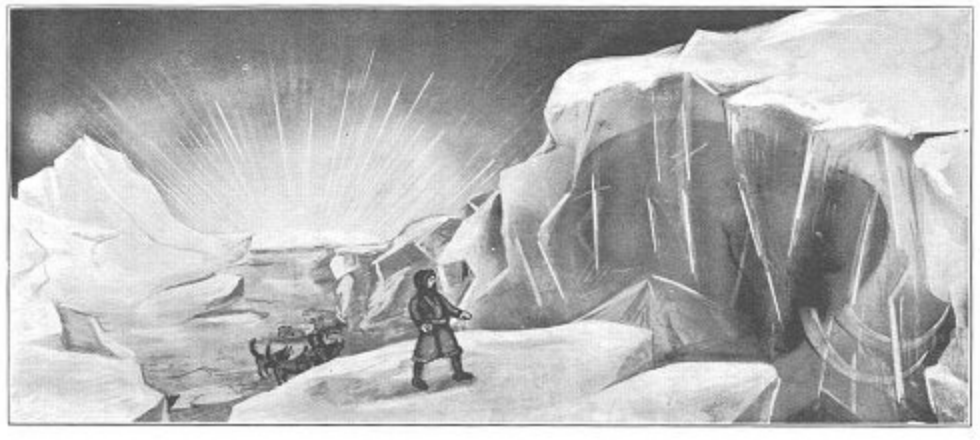
These observations concern the presence in the polar regions of the mammoth. That scientists should find old tusks and remains of this animal is perhaps surprising, though it could be explained in some way or other; but they also find perfectly fresh bodies of these animals. They reason that these fresh bodies were preserved in that condition in the ice for hundreds, perhaps thousands of centuries, but we shall show that this is not the case. But let us marshal our evidence gradually.

The reader will remember that the mammoth and the mastodon are two elephant-like animals but much larger than our elephant of the tropics. They were vegetarian animals and, like the elephant, inhabitants of a warm country. When their remains were first discovered in the polar regions, therefore, it was thought that at one time the polar regions had been very warm, with plenty of vegetation, and that owing to the gradual change of the earth's axis, the area which was once hot had gradually been brought into positions where it grew colder until at last the mammoth and mastodon were frozen out. Let us see whether this idea fits all the facts in the case. But first let us see what those facts are.

In J. W. Bud's "The World's Wonders" we read:

"The farther north we penetrate, in greater abundance are found vestiges of elephants, tortoises, crocodiles, and other beasts and reptiles of a tropical climate. These are found in greatest abundance along the banks of rivers

flowing from the north, seeming to prove that there is, somewhere beyond the frozen belt not yet penetrated by man, a warm country, with climate and productions similar to those of the tropics. Along the borders of Siberia, the remains of tropical animals are so commonly found as to constitute a considerable source of commerce. In Asiatic Russia there is not a single stream or river on the banks or in the bed of which are not found bones of elephants, or other animals equally strange to that climate. In 1799, a fisherman of Ton-goose, named Schumachoff, discovered a tremendous elephant--perfect as when thousands of years before, death had arrested its breath--encased in a huge block of ice, clear as crystal. This man, like his neighbors, was accustomed, at the end of the fishing season, to employ his time in hunting for elephant tusks along the banks of the Lena River, for the sake of the bounty offered by the government; and while so employed, in the ardor of his pursuit, he passed several miles beyond his companions when suddenly there appeared before his wondering eyes the miraculous sight above alluded to. But this man was ignorant and superstitious, and instead of hastening to announce his wonderful discovery for the benefit of science, he stupidly gazed upon it in awe and wonder, not daring to approach it. For several successive seasons from the time when he first discovered it, did Schumachoff make stealthy journeys to his crystallized monster, never finding courage sufficient to approach it closely, but simply standing at a distance, once more to feast his eyes on the wonder, and to carry away in his thick head enough of terror to guarantee him a nightmare for a whole month of nights. At last he found the imprisoned carcass stranded on a convenient sand-bank, and boldly attacked it, broke the glittering casing, and roughly despoiling the great beast of its splendid tusks, hurried home and sold them for fifty roubles, leaving the well preserved bulk of elephant meat, thousands of years old, yet juicy and without taint, to be devoured by wolves and bears or hacked to bits by natives as food for their dogs."



IN PERFECT PRESERVATION

We next turn to Dr. H. D. Northrop's "Earth, Sky, and Sea", where we find some later information about this same case. It seems that after the fisherman had left the mammoth carcass he told of its whereabouts and a party set out to examine it:

"For some time the flesh of this animal was cut off for dog-meat by people around, and bears, wolves, gluttons, and foxes, fed upon it till the skeleton was nearly cleared of its flesh. About three-fourths of the skin, which was of a reddish-gray color, and covered with reddish wool and black hairs about eight inches long, was saved, and such was its weight, that it required ten men to remove it; the bones of the head, with the tusks, weighed four hundred and sixteen pounds. The skeleton was taken to St. Petersburg, where it may still be seen in the Museum of Natural History. The animal must have been twice the ordinary size of the existing elephant, and it must have weighed at least twenty-thousand pounds."

REMAINS OF TROPICAL ANIMALS

This same author goes on to say:

"Every year in the season of thawing (in Northern Asiatic Russia) the vast rivers, which descend to the Frozen Ocean in the north of Siberia, sweep down with their waters innumerable portions of the banks and expose to view the bones buried in the soil and excavations left by the rushing waters. It is curious that the more we advance toward the north of Russia, the more

numerous do the bone depositaries become. In spite of the undoubted testimony often repeated, of numerous travelers, we can scarcely credit the statements made respecting some of the islands of the glacial sea near the poles, situated opposite the mouths of the Lena and of the Indigirska.

"All the islands nearest to the mainland, which is about thirty-six leagues in length, except three or four small rocky mountains, are a mixture of sand and ice, so that when the thaw sets in and their banks begin to fall, many mammoth bones are found. All the isle is formed of the bones of this extraordinary animal, of the horns and skulls of buffaloes, or of an animal which resembles them, and of some rhinoceros horns.

WHOLE ISLAND OF REMAINS

"New Siberia and the Isle of Lachon are for the most part only a mass of sand, of ice, and of elephant's teeth. At every tempest the sea casts ashore new quantities of mammoth's tusks, and the inhabitants of Siberia carry on a profitable trade in this fossil ivory. Every year during the summer innumerable fishermen's barks direct their course towards this isle of bones, and during winter immense caravans take the same route, all the convoys drawn by dogs, returning laden with the tusks of the mammoth, weighing each from 150 to 200 pounds. The isle of bones has served as a quarry of this valuable material for export to China for five hundred years, and it has been exported to Europe for upwards of a hundred. But the supply from these strange mines remains undiminished."

All we have to say to those last statements is that the supply must be replenished right along or such a thing could not be so everlasting. And we think there can be no doubt that these supplies of remains have been and are being replenished right to the present moment.

In his book, "In the Lena Delta", George W. Melville, the United States naval officer and explorer, also tells of the immense tusks, in this case stained black by being buried in peat bogs, which he saw in that country. In some cases they measured nine feet along the curve, and were thirty inches in circumference at the end near the skull. He saw one train of thirty sleighs laden with the tusks on its way to China.

Our next witness is Nordenskiold who tells in his "Arctic Voyages" of the traffic in mammoth tusks along the river Yennssej to China and Russia. A little later he says:

"In the Siberian Polar Sea, the animal and vegetable types, so far as we can judge beforehand, exclusively consist of survivals from the Glacial period which next preceded the present, which is not the case in the Polar Sea where the Gulf Stream distributes its waters and whither it thus carries types from more southerly regions."

It is evident that Nordenskiold has forgotten that the currents which he thinks carry southerly types to the polar sea, really come from the north, from the polar regions. And we shall show that these animals which are apparently survivals from the glacial period are really inhabitants of the interior of the earth which, owing to its climatic conditions, is now the home of animals and vegetable species which flourished on the outer surface of the earth in the carboniferous era of giant ferns, mammoths, and other species characteristic of that period of damp, steamy, warm climate.

A PUZZLE TO THE GEOLOGIST

But Nordenskiold admits that the finding of mammoth bones, etc., in the Siberian "tundras" or immense plains of sand drifts, is a puzzle to the orthodox geologist. For these drifts were formed quite recently, and yet they contain remains of animals which the orthodox scientist believes to be thousands of years old and no longer existing. He says:

"The tundra has been formed under climatical conditions very similar to the present, which is further confirmed by the geognostic formation of the strata. It has, therefore, long been difficult of explanation for the geologist that just in those sandy strata is found a large number of remains of mammoths, rhinoceroses, etc., that is to say, of animal types which for the present live only in tropical or sub-tropical climates. Collections from these regions have a peculiar interest from the remarkable circumstance that in the frozen soil of the tundra are found, not only skeletons, but also flesh, hide, hair, and entrails of animal forms which died out many thousands of centuries ago. Among our collections may be mentioned, large pieces of mammoth hide found along with some fragments of bone where the Mesenkin falls into

the Yenissej, the skull of a musk-ox, remarkable for its size, found with fragments of mammoth bones in another tundra valley south of Orlovskoj, a very rich collection of sub-fossil shells found principally between Orlovskoj and Gostinoi."

Now that is a very clear statement of the difficulty in which the orthodox scientist finds himself. Here is a new formation--the tundra--and in it he finds skins and bones and entrails of animals which are supposed to be some thousands of centuries old. It is obvious that they cannot be as old as that, or else they would not be there. And the fact that parts of hides and entrails are found--not fossilized but simply frozen--and that semi-fossilized shells are also found, shows that the shells are older than the hides and bones. For in thousands of centuries the hides and entrails would certainly have disintegrated and left nothing but fossil imprints. A little later Nordenskiold says:

"Few scientific discoveries have so powerfully captivated the interest both of the learned and unlearned as that of the colossal remains of elephants, sometimes well preserved with hair and flesh in the frozen soil of Siberia. Such discoveries have more than once formed the object of scientific expeditions and careful researches by eminent men, but there is still much that is enigmatical with respect to a number of circumstances connected with the Mammoth period of Siberia, which *perhaps* was contemporaneous with our Glacial period. Specially is our knowledge of the animal and vegetable types, which lived at the same time as the mammoth, exceedingly incomplete, although we know that in the northernmost parts of Siberia, which are also most inaccessible from land, there are small hills covered with the bones of the mammoth and other contemporaneous animals. . . ."

IN THE NEW SIBERIAN ISLAND

A little later Nordenskiold sailed for the New Siberian Islands:

"These islands are very remarkable from a scientific point of view, being very rich in the remains of the mammoth and other animals of the same period, which are found in greater abundance among them than on the tundra of the mainland. Some of the sand-banks on their shores are so full of the bones and tusks of the mammoth that the ivory collectors who for a series of

years traveled every year from the mainland to the islands in dog-sledges, used to return in autumn when the sea was again covered with ice, with a rich harvest. According to Hedenstrom, the only educated person who has examined these islands in summer, there are besides in the interior hills which are covered with the remains of the mammoth, the rhinoceros, horse, aurochs, bison, sheep, etc."

Special collections were made by Nordenskiold of specimens that would aid him in determining what he admitted was a "difficult problem": how it was possible for the progenitors of the Indian elephant to live in the ice deserts of Siberia.

Yes the problem is difficult when you do not know all the facts, but when we know that the mammoth still lives in the interior, then we can easily understand the situation.

Perhaps the reader says, "But you have not actually proved that yet". But let the reader wait until all the evidence is in. We wish to put the matter beyond the shadow of a doubt, and so we call upon every witness who has seen these remains, but we shall leave the most remarkable case until the last.

OTHER SIMILAR DISCOVERIES

In Edwin S. Grew's "The Romance of Modern Geology" we read of the finding of mammoth remains in France including a tusk which is carved with a rough but clever picture of a mammoth. That proves that the animal still existed on the outer surface of the earth when mankind had come upon the scene. Mr. Grew also confirms the facts we have told above of the finding of the complete mammoth in the ice by the Russian fisherman in Siberia. He adds that Mr. Adams of the St. Petersburg Museum was sent by the Czar to examine the carcass and found it in a still fresh condition.

He tells us that:

"The Yakuts of the neighborhood had cut off the flesh, with which they had fed their dogs; wild beasts, such as white bears, wolves, wolverines, and foxes had also fed upon it, and traces of their foot-steps were seen around. The skeleton almost cleared of flesh, remained whole, with the exception of one foreleg. The spine of the back, one scapula, the pelvis, and other three

limbs were still held together by the ligaments and by parts of the skin; the other scapula was found not far off. The head was covered with a dry skin; one of the ears was furnished with a tuft of hairs; the balls of the eyes were still distinguishable; the brain still occupied the cranium but seemed dried up; the point of the lower lip had been gnawed and the upper lip had been destroyed so as to expose the teeth; the neck was furnished with a long flowing mane; the skin, of a dark-grey color, covered with black hairs and a reddish wool, was so heavy that ten persons found great difficulty in transporting it to shore.

THE CARCASS OF THE MAMMOTH

"There was collected, according to Mr. Adams, more than thirty-six pounds weight of hair and wool which the white bears had trod into the ground while devouring the flesh. This mammoth was a male, so fat and well fed, according to the assertion of the Tungusian chief, that its belly hung down below the joints of its knees. Its tusks were nine feet, six inches in length, measured along the curve, and its head without the tusks weighed four hundred and fourteen pounds avoirdupois."

But Mr. Grew has something even more remarkable than this corroborative testimony to tell us, and we shall quote other writers to confirm him. He goes on in this same book to tell of:

"A very curious example of the Siberian Mammoth was discovered only a few years ago by a Lamut of one of the Arctic Villages, and through the energy of Dr. Herz was eventually removed in pieces to St. Petersburg. . . . . It was sunk in frozen ground, and this cold storage treatment had preserved it in an extraordinary manner. If the Siberian natives who had discovered it partially buried in alluvial deposit had not uncovered it, so that the sun was able to play on the carcass and produce decay, this wonderful primeval monster might almost have been got out whole. As it was, the frozen ground had so kept the remains that Dr. Herz had found well-preserved fragments of food between the teeth, and the remains of a hearty meal in the stomach. There is no doubt that the Mammoth fell into the crevice or pit and damaged himself so much in the fall that he could not crawl out. . . . . ."

COULD NOT BE "PRIMEVAL"

The reader will notice that Mr. Grew refers to this mammoth as a "primeval" monster. And that is an example of the sort of thinking that has set all the scientists wrong on these questions regarding the polar regions. Instead of studying the actual facts as we have done in this book they come to the facts with certain fixed ideas in their heads, and they can only understand as many of the facts as fit into their ideas. Everything else they pass by as being of no importance. The reader will see that Mr. Grew has read in his previous studies that the mammoth was a primeval animal--which is true enough as far as it goes. It was a very early animal, and in all the outer world is now extinct. But when he hears of a perfectly fresh carcass being discovered, it never occurs to Mr. Grew nor to Dr. Herz nor to Nordenskiold nor to any other explorer, to think anything else than what he has always thought. They still think of the animal as extinct although its fresh carcass is before them, and they try to explain the freshness of the carcass by saying that it was preserved by the ice.

COMES FROM WARM CLIMATE

But the mammoth and mastodon are inhabitants, as we have seen, of warm climates, and if the animal we have just read about fell into that crevice when he and his fellows still roamed on what must then have been the much warmer climate of Siberia than the present one, it follows that it was many years before the ice came and froze the animal in its grave.

We claim, it will be seen, that if these animals lived in a certain climate--whatever the climate of Siberia happened to be in the days when scientists claim that the mammoth lived--either one of two things must have happened. If the climate gradually grew colder they would be driven off by the inclemency of the change. If it did not change they would be living in Siberia still. But there are no mammoths in Siberia now. So they were driven somewhere by the growing cold. We claim that they took refuge in the interior of the earth--from whence, for all science can prove to the contrary, they may have come in the first place. We further claim that the fresh remains of their bodies which have been found in Siberia are those of mammoths which in their wanderings came a little further south than usual--for the

climate around the polar openings would be quite warm enough for them, and that these animals fell in to ice crevasses in places from which they were carried to the present situations by the movements of the ice--by those great glaciers which have from time to time been referred to in accounts of Greenland.

SUPPOSING THEY WERE A MILLION YEARS OLD

For consider the alternative supposition. Suppose the mammoth referred to above had really fallen into a pit or water hole a million or so years ago. Suppose that almost immediately afterwards the climate became so cold that the body was frozen in; and climate never does change so quickly. Even in that short interval the food in the stomach and between the teeth would have decomposed. Food begins to break up the minute it reaches the stomach and is acted on by the gastric juice. The heat and moisture of the mouth is such that all food not washed away from the teeth immediately after eating begins to decompose. It would not take a pretentiously educated scientist or veteran Arctic explorer, it would take no more scientifically equipped man than any dentist to tell that when a carcass is found frozen with fresh food between its teeth, that carcass was frozen either immediately after death or even frozen to death.

CONTRADICTIONS IN THAT VIEW

No, there is no getting away from the fact that the mammoth was alive after the ice was formed, and in some manner fell into a crevasse and was frozen. And the only place the mammoth could come from to meet such a fate is the interior of the earth, because the interior of the earth and possibly all the land around the polar lips is the only climate in the north where he could survive. When the Siberian climate became cold the means of escape to the south was shut off. If it had not been, the mammoth might have migrated south and been alive in the warmer regions today. But we have seen that the ross-gull and other birds as well as the foxes and bears go north when the winter sets in, and the mammoth either came from the interior of the earth in the first place or else he sought it for a refuge when the Siberian wilds became too cold for him.

OTHER DISCOVERIES

Apart from that there is no explanation of these remains at all. R. Lyddeker, a British biologist, writing in *Knowledge* for 1892 says:

"Along the borders of the Arctic Ocean for hundreds of miles mammoth remains are met with in incredible quantities; and it is still one of the puzzles of geology to account adequately and satisfactorily for the manner in which these creatures perished, and how their bodies were buried beneath the frozen soil before decomposition had begun its work, for it is hardly possible to believe that they lived in a climate so rigorous that their bodies would have been frozen on the ground immediately after death."

FREEZING INSTANTANEOUS

The same writer in *Knowledge* for 1892, tells of the many discoveries of mammoth flesh in fresh condition and mentions that the natives of Siberia as well as their dogs have eaten of the flesh another striking proof of its freshness. But perhaps the most remarkable testimony of this sort is the fact that an actual banquet has been served from the flesh of this supposedly extinct animal. Readers may remember the newspaper reports of that banquet, several years ago, in Petrograd, at which the flesh of the mammoth, wheat from Egyptian tombs, and other preserved products from the remains of Pompeii and Herculaneum were among the items served, the idea being to serve only those things which were thousands of years old. Unfortunately, the scientists had not gone into the history of the mammoth as profoundly as they might, or they would have seen the inconsistencies in their theories which we have pointed out above. And then they would have had to omit the mammoth steak, or at least admit that it was not as old as the other viands they served at this scientific banquet.

But perhaps the reader is not willing to see a whole argument based on what he may consider the one isolated example of a mammoth found with fresh food between its teeth. He may say one witness is not enough in an important case like this. Very well; let us cite another witness. In June, 1894, Dr. Stephen Bower, one of the foremost American geologists, contributed a long article on extinct animals to the Scientific American Supplement. Of

course, like other scientists, he thought that the mammoth was extinct, but he knew that its flesh had been eaten by man--in fact his reference to that fact may be caused by his knowledge of the banquet at Petrograd to which we have referred above. In any case he begins his remarks about the mammoth as follows:

"While the monsters we have described perished many ages before man appeared on the earth, and have never been seen by him alive, the monster of which we are now about to write has been seen by man and its flesh eaten by him. That, however, was after it had been entombed for untold ages in the ice of Arctic regions. The remains of the mammoth are widely diffused over the earth. They have been found in great abundance not only in North America, but also in the frozen regions of Siberia, and indeed all over Asiatic Russia. . . . As far back as the tenth century an active trade has been carried on in fossil ivory. It is estimated that during the past two centuries more than two hundred pairs of fossil tusks have come into the market annually, and the localities where found are far from being exhausted. After more than forty thousand pairs have been obtained from northern regions the traveler finds them increasing as he approaches toward the north pole. It is said that the soil of Bear Island and Liachoff Island, New Siberia, consists of sand and ice with such quantities of Mammoth remains that they appear as if they were made up of bones and tusks."

Let us break off just a moment to remind the reader how the above corroborates what we have said as to the greater frequency of life and the remains of life as we approach the north polar regions--even the mammoth bones tell the same tale as the gulls and foxes and bears.

Dr. Bowers then proceeds to verify once again the facts we have already heard of:

"But not only have the fossil remains of the Mammoth been found all over the arctic lands as far as man has penetrated, but their bodies, as we have intimated, have been found intact, frozen and preserved in the ice. In the year 1800, the entire body of a mammoth was discovered in a vast stratum of ice on the banks of the river Lena. Afterwards it became disengaged from its icy matrix and white bears, wolves, foxes and dogs fed off its flesh. It was a male and had a long mane on its neck."

ANOTHER INSTANCE

And Dr. Bowers gives once more the details which we already know. He goes on, however, to tell of another instance which other writers have also mentioned:

"A young Russian engineer, named Benkendorf, in the employ of his government, ascended the Indigirka in a steamer in 1846. The season was unusually warm for Siberia, and the country was flooded with water. The stream, which was greatly swollen, cut new channels in many places, melting the ice and frozen soil. In one of these newly cut channels he discovered a mammoth in an upright position, where it had been overwhelmed, probably thousands of years before. As its head and trunk rose and fell with the surging waters he discovered that it was still fastened in the ice and frozen soil by its hind feet. The monster was secured by throwing ropes and chains over its tusks and head, and after its hind feet were released it was safely landed by the aid of more than fifty men and horses. It proved to be of gigantic size, and the whole body was in a fine state of preservation. In its stomach was found the food that had formed its last repast, which consisted of young shoots of the fir and pine, also young fir cones. On the shoulders and along the back grew stiff hairs about a foot long. The hair was dark brown and coarsely rooted. Under the outer hairs there appeared everywhere a soft, warm and thick wool of a fallow brown color."

Dr. Bowers can only account for this surprising freshness by supposing that the freezing of the animal was instantaneous, and his own theory is that there was a sudden change in the climate which he puts at about the lateness of what he calls the "Noachian deluge". But that is very unscientific, as we know now that changes in climate are gradual, and in serious scientific discussions it is not usual to bring in Noah and the biblical account of the deluge. But in spite of the difficulties, Dr. Bowers makes the most generous acknowledgement of the absolute freshness of this and other specimens found. He even says:

"Many of the animals, as the mammoth, rhinoceros, etc., remain undecayed. Even the capillary blood vessels still retain their contents, showing that there was not the slightest decomposition or breaking down of the tissues, but the catastrophe which overwhelmed them was sudden."

Of the mammoth, therefore, we have the mass of evidence cited to show that the interior of the earth is its habitat. The scientists who have not had this theory to work with have confessed that they cannot explain the phenomenon. But once supply the link which our theory gives and the whole sequence is complete. The mammoth is wandering today in the interior of the earth. When he ventures too near the polar orifice--it must be remembered that the mammoth and mastodon and elephant are all characterized by a tendency to wander widely--he becomes stranded on a breaking ice floe and carried over from the interior regions, to the outer regions or perhaps falls in a crevasse in ice which afterwards begins to move in some great glacial movement. In these ways the bodies are carried over to Siberia and left where we have seen them discovered. That such a process has been going on for thousands of years is seen from the abundance of remains. Evidently the migratory instinct, which does not change for thousands of years even when the conditions which started it do change, is still working in these animals. And so we have from time to time their silent testimony to the existence and mild climate and vegetation of that interior land which supports them, and which has been giving this and other testimony for so many years without any of our learned scientists as much as once correlating and putting together the evidence--evidence which they alone among us have had the opportunity of collecting but which they collected piece meal, unaware if its importance, puzzled by it, occassionally admitting that they were puzzled, but which they never faced squarely with minds free from preconception. But at last all this evidence has been gathered together. More of it will undoubtedly be forthcoming. And, not for the first time in the history of thought, the orthodox scientists will have to admit that they were wrong in their interpretation of the facts of polar research, and that there is really something new to be found out.

THE MAMMOTH BANQUETS

We have referred to the eating of mammoth flesh by scientists and their guests at a banquet, and this evidence of the freshness of the meat of the animal is so remarkable that our readers may well wish to know all the details. As a matter of fact the eating of mammoth flesh by human beings has occurred more than once according to recent reports in newspapers, and, of course, there may be hundreds of cases among the Eskimos or inhabitants of

Siberia where some of the carcasses have been found in a fresh condition.

The most talked about mammoth banquet was that given by Professor Herz, of the Imperial Academy of Science of St. Petersburg--as it was then--who had been leader of the expedition into Siberia which unearthed and transported the mammoth in question to the Imperial Museum. Only the bones and the skin were needed for mounting in the museum, and as the professor had kept the whole carcass in cold storage it suddenly occurred to him that it would be quite possible to eat the flesh. Of course he was under the impression that this flesh was over 20,000 years old, an idea which we have already shown to be quite wrong, and he asked scientists in other parts of the world to contribute other ancient foods--such as corn dug up from the ruins of Egyptian cities. As the mammoth flesh was not old at all we need not speak of the other and older items of this feast. What does concern us is what the guests thought of the meat. But the account of the banquet says that the banquet was a triumph: "particularly the course of mammoth steak, which all the learned guests declared was agreeable to the taste, and not much tougher than some of the sirloin furnished by butchers of today."

Another mammoth meal was eaten by an American traveler and author, Mr. James Oliver Curwood, who was exploring in the far north when his Eskimo fellow travelers found the body of a mammoth exposed by the falling of a cliff-side. Before quoting Mr. Curwood we should like to point out how little the scientists really know about such matters by contrasting what he gives as the animal's age with what Professor Herz gave. Herz put it at 20,000 years; Curwood, quoted in The Chicago Tribune for July 7th, 1912, puts it at 50,000 to 100,000 years. As we have already shown, Herz is nearer the truth than Curwood. But at that he is about 20,000 years wrong. However, here is what Mr. Curwood has to say:

THE FRESH MEAT

"The flesh was of a deep red or mahogany color, and I dined on a steak an inch and a half thick. . . . The flavor of the meat was old not unpleasant but simply old and dry. That it had lost none of its life-sustaining elements was shown by the fact that the dogs throve upon it."

What Mr. Curwood calls an old flavor--really there could be no such thing

any more than there could be a yellow or a blue flavor--is simply the strong flavor due to the character of the animal. Anyone who has eaten bear steak or even venison and contrasted the flavor with beef or mutton will know just what Mr. Curwood is really trying to say.

But there is on record of at least one more mammoth banquet, this time given by Gabrielle D'Annunzio from the flesh of another mammoth, the bones of which repose in a Paris Museum. Here is part of the story as cabled to the Chicago Examiner some years ago:

"Paris, Jan. 31--Meat between forty and fifty thousand years old was the star dish at a banquet given by Gabriele D'Annunzio, the Italian dramatist and poet, at the Hotel Carlton last evening.

"D'Annunzio obtained the flesh from Russia where it was cut from the carcass of a mammoth which was dug out of the ice around the Liakoff Islands, north of Siberia, by Count Stembock Fermer. The count has presented the pachyderm to the Paris Museum of Natural History, where it is about to be exhibited.

"The body embedded in the eternal ice was in perfect condition, at the time of its discovery, a large quantity of the flesh was kept in cold storage and shipped to St. Petersburg.

"This fifty thousand year old frozen meat is being treasured in Russia, but after repeated efforts, D'Annunzio, through influential friends, succeeded in obtaining several pounds of this rare food-stuff.

D'ANNUNZIO'S BANQUET

"Yesterday's sensational dinner was preliminary to the competition for the Fontenoy Cup, awarded by the French Greyhound Club, of which the poet is one of the most enthusiastic members. His guests were five fellow members of the club and covers were also laid for the favorite hounds of the guests. Describing the banquet afterward to the Examiner correspondent, D'Annunzio said:

"'It was the most successful dinner I ever gave. The elephant meat exceeded my highest expectations. In flavor it was like tortoise flesh, but it

was, well--a little tough. . . . . I had it broiled and served with six different kinds of sauce.'"

Of course the reader will notice that D'Annunzio like everyone else thinks the mammoth flesh was much older than it is in this case forty thousand years is mentioned as a possible age as well as fifty thousand. Now what do the scientists mean by saying a thing is forty thousand years old, then fifty thousand, and then a hundred thousand years? Does not that mean that the whole thing is a guess? Otherwise, the man who said it was forty thousand years old would have some reason for that estimate and that reason ought to convince the man who says it is fifty thousand years and him who says 100,000 years. Or else the 100,000 year old theory ought to convince the other fellows. Some of them, at least, ought to have some actual evidence on which to base their figures. But as there is no evidence at all, we find guesses all the way from 20,000 to 100,000 years for the age of the mammoth and we find nothing except these guesses, not a single cogent argument. That being the case, it ought to be obvious that a theory such as ours, which explains the actual facts of the case, must supplant these wild guesses. The reason the scientists who say 20,000 or 50,000 or 100,000 years cannot agree is that none of them is right. If any one of them were right he would be able to convince the others by some actual proof or argument. But as all are wrong--almost equally wrong, one might say, although their errors differ by a few thousand years no one man can convince the other. Our own pointing out of the actual facts in the case at once clears away the fog and explains everything in a clear and satisfactory manner.

CHAPTER XII. THE LIFE OF THE ARCTIC

In describing the voyages of different explorers we have spoken more than once of their observations of living creatures in the Arctic and Antarctic regions--creatures which could find no sustenance if there were not warmth and fertility in those regions. Perhaps the reader was inclined to think that the first few instances we adduced were exceptional, but as he found explorer after explorer making the same observation we are sure that he became more and more impressed.

But in order to show the full weight of this evidence we shall bring it all together in the present chapter, arranging it according to the various species observed, so that a complete picture of arctic animal and plant life will be spread before the reader--and that picture when viewed as a whole is a complete proof of our theory--for the number and variety of animals and plants which figure in it is so great that their occurrence in any but a region where they had a firm and abundant basis for their life--such as the interior of the earth supplies--would be absolutely impossible.

GENERAL VIEW OF ARCTIC ANIMAL LIFE

Let us first remind the reader that these birds and animals and flowers of the Arctic regions are no new feature of them but have been there as far as the memory of man goes back. We have seen how the Eskimos have old traditions of them. When we come to later times we find the animals and plants still there. Some of the earliest testimony about them, the earliest testimony of modern times, that is, has been collected by the scholar whom we have already quoted, the Hon. Dames Barrington, in his book "On the Possibility of Approaching the North Pole." He tells us not only that driftwood is driven on the north coast of Iceland which could come from no other quarter than the north, but that among other fresh pieces whole trees were found which yet had their buds on them, something which would have been absolutely impossible if this wood had drifted long distances from southern climes. It is obvious that a very few months in salt water would kill the buds, but here were trees which had evidently been growing only a short time before. And he further tells us that observers in Spitzbergen have always

noticed that in spring, just before the hatching season, the wild ducks, geese, and other birds, fly in a northernly direction. There is also a heavy fall migration to the north.

PHENOMENA OLD AND WELL ESTABLISHED

Another early modern writer has this to say of the animals and fish of the north:

"It is a fact well attested by whalers and fishers in the northern seas, and one that almost every author who adverts to the northern fisheries confirms, that innumerable and almost incredible numbers of whales, mackerel, herring, and other migratory fish annually come down in the spring season of the year, from the arctic seas toward the equator. Some authors describe the shoals of herring alone to be equal in surface to the island of Great Britain. Besides these, innumerable shoals of other fish also come down. These fish when they first come from the north in the spring, are in their best plight and fattest condition; but as the season advances and they move on to the southward, they become poor; so much so that, by the time they get to the coast of France or Spain, as fishermen say, they are scarce worth catching.

IMMENSE SHOALS OF FISH

"The history of the migratory fish affords strong grounds to conclude that the shoals which come from the north are like swarms of bees from the mother hive, never to return. They are not known to return in shoals; and it is doubted by some writers whether any of them ever return north again. . . ."

To that we would simply add that a source of life so prolific and never failing that it is likened to a hive, a place where the fish breed and from which they come in shoal after shoal, is just what one might expect to find in the well warmed interior of the earth. One could never imagine such a place under a sea of solid ice. But our authority proceeds:

"Pinkerton, in his voyages, states that the Dutch, who at various periods got detained in the ice and were compelled to winter in high northern latitudes, could find but few fish to subsist on during the winter; which proves that the migrating fish do not winter amongst or on this side of the

ice."

WHERE DO THESE FISH WINTER?

It follows from that, that there must be immense fish-breeding grounds on the other side of the so-called polar ice, for only in a favorable location could these shoals live and breed--and it must be remembered that they would require an immense quantity of food, and only in a very temperate sea would enough food grow.

THE SEAL

To quote a little further:

"The seal, another animal found in cold regions, is also said to migrate north twice each year; going once beyond the icy circle to produce their young, and again to complete their growth, always returning remarkably fat--an evidence that they find something more than snow and ice to feed on in the country to which they migrate."

In "Ree's Encyclopedia" there is one of the early articles descriptive of Hudson's Bay, and it is there stated that reindeer "are seen in the spring season of the year, about the month of March or April, coming down from the north, in droves of eight or ten thousand, and that they are known to return northward in the month of October, when the snow becomes deep." The account goes on to say:

THE REINDEER

"We are informed by Professor Adams, of St. Petersburg, that on the northern coast of Asia, every autumn the reindeer start northeastwardly from the river Lena, and return again in the spring in good condition."

Short of such a hospitable country as is afforded by the interior of the earth, where could these animals possibly find warmth and nutriment?

MUSK-OXEN

Among early nineteenth century accounts of northern explorations, "Hearne's Journal" is one of the most interesting. In its pages we may read that large droves of musk-oxen abound in the arctic regions, as many as several herds each aggregating seventy to eighty head being seen by Hearne in one day. Few of them ever came as far south as the Hudson's Bay settlements. He also states that polar white bears are rarely seen in the winter and that their winter habitat is a mystery. But in the spring they suddenly appear from some unknown place having their young with them.

Hearne goes on to tell us that white foxes are exceedingly plentiful some years, and that they always come from the north; that the animals which appear do not go again to the north, so that the supply from there must be inexhaustible. Other species of animals and fish, he tells us, are plentiful some years and very scarce in other years, which would indicate, perhaps, that under certain conditions of weather they migrate within the interior of the earth instead of coming over the ice barriers to the exterior.

VARIOUS WILD FOWL

Hearne has also some very interesting observations about the large numbers of swans, geese, brants, ducks, and other wild water-fowl which are so numerous about Hudson's Bay. Of geese alone there are ten different species, several of which he says--particularly the snow goose, the blue goose, the brent goose, and the horned wavy goose--lay their eggs and raise their young in some country which to Hearne was unknown--as indeed it has been to all explorers, for that country is no other than the interior of the earth. Even the Indians or Eskimos who had explored all the habitable countries in those regions, could never tell where these fowl bred, and it was well known that they never migrated to the south, and as many of these fowl moulted in the sea-son when they were visible in Hudson's Bay it was certain that they did not breed there for a moulting bird cannot sit on the nest--the moulting and the breeding seasons being always separated.

DRIFTWOOD AND SEEDS OF PLANTS

Now let us follow in further detail the evidences of these various forms of life in the Arctic. We have already spoken of driftwood being found where it

could only have come from the interior of the earth. This is such a common occurrence that every explorer almost that we have followed has had .something to say about it. But occasionally even stranger things than trees with green buds on them are found in the Arctic seas. Seeds of unknown species as well as of tropical species have been found, drifted down in northern currents. One very interesting find of this nature was the seed of the entada bean, a tropical seed measuring two and a quarter inches across. This remarkable find was made by a Swedish expedition under Otto Torell near Trurenberg Bay, and it is obvious that this seed must have come from the interior of the earth for it is of a tree that only grows under tropical conditions, and it would have been disintegrated had it been drifting all over the world for many months, as would be the case if it had come up from the tropical regions of the exterior of the planet.

W. J. Gordon, who recounts this find in his "Round About the North Pole" also adduces evidence that in the past there was a great variety of vegetation in Greenland, including magnolia, maple, poplar, lime, walnut, water-lily, myrica, smilax, aralia, sedges and grasses, conifers and ferns. And it is obvious that these plants were not migrants into Greenland from the south. They could not pass oceans and icy coasts. They must have come over to Greenland from the warm interior.

MORE ABOUT REINDEER

Gordon also corroborates what we have just read from Ree's old time but accurate observations about reindeer. He tells us that one of the earliest explorers to find this animal in very large numbers, and on its way from some unknown land in the north, was Liakhoff, after whom Liakhoff Island was named, who saw a "mighty crowd" of them, and ascertained that their tracks were all from the north.

Gordon also tells us of Sverdrup's finding of so many hares around latitude 81 degrees that one inlet was actually called Hare Fiord. There was also enough other game to keep the whole exploring party well fed on fresh meat.

Another author who throws much light on this subject is Epes Sargent who, in collaboration with W. H. Cunnington, has written "The Wonders of

the Arctic World." In describing the work of Buchan and Franklin, he tells us that one observer in their party, Captain Beechey, saw reindeer grazing on the west coast of Spitzbergen at an elevation of fifteen hundred feet. Meanwhile, there were so many birds that the place reverberated with their cries from dawn till dark, and the little auk were so numerous that uninterrupted lines of them would extend all over the bay where the party was resting, and so close together that sometimes thirty fell at one shot. The living column was six yards broad and as many deep, and allowing sixteen birds to a cubic yard, there would be four million of them on the wing at the same time. While, Captain Beechey adds, that number appears very large, the little rotges rise in such numbers as to darken the air, and their chorus is distinctly audible at a distance of four miles. Meanwhile, the islands were thickly populated with eider-down ducks, and the "sea about Spitzbergen is as much alive as the land, from the multitude of burgomasters, stront-jaggers, malmouks, kittiwakes, and the rest of the gull tribe, while the amphibious animals and fish enliven both the ice and the water, from the huge whale to the minute clio on which it feeds, swallowing, perhaps, a million at a mouthful."

Later in this book Sargent tells us that Franklin's second expedition saw large numbers of geese migrating to the unknown north, as well as many other birds--sure indication of land to the north. Still later he mentions "innumerable flocks of Arctic and blue gulls, besides almost a dozen other species." He also notes the fact that no matter how far north the human explorer goes he always finds that the polar bear is a little ahead of him, and no matter how far north these bears are met with they are always on their way further north.

Speaking of Dr. Kane's voyages this same author says:

"It was found that animal life abounded. Musk-oxen were shot at intervals throughout the winter . . . Wolves, bears, foxes, and other animals were repeatedly observed. Geese, ducks, and other water-fowl including plover and other wading birds, were very plentiful during the summer . . . there were large numbers of ptarmigan or snow partridge . . . The waters were found to be filled to an extraordinary degree with marine invertebrata, including jelly-fish and shrimps. Seals were very abundant. Numerous insects were observed also, especially several species of butterfly, flies, bees, and insects of like character. Quite an extensive and varied collection of specimens was

secured." --and those observations were made north of latitude 82.

Cunnington also tells of the finding of much drift-wood by the McClure expedition, some of which in the opinion of the ship's carpenter had not been subject to a very long immersion in the water. McClure himself reports on this expedition that his men saw reindeer and killed musk-oxen on the shores of Prince of Wales strait, and he adds that it is pretty evident that during the whole winter animals may be found in these straits, and that the want of sufficient light alone prevents our larder being stored with fresh food. And Commander Osborne adds to this testimony the following remarkable admission: "Subsequent observation has completely overthrown the idea that the reindeer, musk-oxen, or other animals inhabiting the archipelago of island north of America migrate southward to avoid an Arctic winter." Later Commander McClure explored Bank's Land and found immense quantities of trees thrown in layers by glacier action evidently that had brought them from the north. Sometimes they protruded fourteen feet from the ground in which they were embedded. One ravine showed along one side a mass of trees tightly packed to a height of forty feet from the bottom of the declivity. The ground around the trees was formed of sand and shingle, showing that the trees had not grown there but had been carried there from some other spot. While some of the wood was petrified much of it was very recent, showing that this process of the trees being carried down had been going on for a great many thousands of years. And Cunnington adds:

"At a subsequent period Lieutenant Mecham met with a similar kind of fossil forest in Prince Patrick Island, nearly one hundred and twenty miles further north."

And yet in the actual latitudes where these trees are found nothing larger than a stunted willow grows. No wonder the people who think the earth is solid are hard put to it to explain where these trees come from.

Nansen himself is puzzled to account for it. In the second volume of his "Farthest North" he speaks of this driftwood which is being continually found on the Greenland coast and whose presence, he says, has caused geographers to doubt if there can possibly be a solid polar ice cap--for if there were where could this wood come from? He says that even as far north as latitude 86 degrees he found such driftwood.

BIRDS AND THEIR MIGRATIONS

In an English work entitled "The Arctic World: Its Plants, Animals and Natural Phenomena" we find further corroborative evidence. The author urges further exploration of the Unknown Region, as he terms it, as the only means of solving the riddles which it presents and which are quite unexplainable according to the orthodox theories. He says:

"There are questions connected with the migrations of birds which can be elucidated only by an exploration of the Unknown Region. Multitudes which annually visit our shores in the winter and spring return in summer to far north. This is their regular custom and obviously would not have become a custom unless it had been found beneficial. Therefore, we may assume that in the zone they frequent they find some water which is not always frozen; some land on which they can rest their weary feet; and an adequate supply of nourishing food."

THE SAND-PIPER IS A PUZZLE

From Professor Newton we adopt, in connection with this consideration, a brief account of the movements of one class of migratory birds--the Knots.

"The knot or sand-piper is something half-way between a snipe and a plover. It is a very active and graceful bird, with rather long legs, moderately long wings, and a very short tail. It swims admirably but is not often seen in the water, preferring to assemble with its fellows on the sandy sea-shores, where it gropes in the sand for food or fishes in the rock pools for some crustaceans . . . Now, in the spring the knot seeks our island (England) in immense flocks, and after remaining on the coasts for about a fort-night, can be traced proceeding gradually northwards, until finally it takes leave of us. It has been noticed in Iceland and Greenland, but not to stay; the summer there would be too rigorous for its liking, and it goes further and further north. Whither? Where does it build its nest and hatch its young? We lose all trace of it for some weeks. What becomes of it?

"Toward the end of summer back it comes to us in larger flocks than before, and both old birds and young birds remain upon our coasts until November, or, in mild seasons, even later. Then it wings its flight to the

south, and luxuriates in blue skies and balmy airs until the following spring, then it resumes the order of its migration."

Commenting upon these facts, Professor Newton infers that the lands visited by the knot in the middle of summer are less sterile than Iceland or Greenland; for certainly it would not pass over these countries, which are known to be the breeding places for swarms of water-birds, to resort to regions not so well provided with supplies of food. The food, however, chiefly depends on the climate. Wherefore we conclude that beyond the northern tracts already explored lies a region enjoying in summer a climate more genial than they possess.

This is a very remarkable corroboration of our theory. Here is a well known bird whose migrations are known in every particular except one--where does it go when it departs for the north? That has been an insoluble question, but at any rate a question which suggests that the far north is not what the scientists have supposed it to be--a barren waste. And when we add to this testimony the fact that animals also disappear in that direction in the winter, we begin to see how certain it is that there is not only a land of mild summer there but of perpetual summer.

MIGRATIONS OF MEN

Our author goes on to say:

"Do any races of men with which we are now unacquainted inhabit the Unknown region? Mr. Markham observes that although scarcely one-half of the Arctic world has been explored, yet numerous traces of former inhabitants have been found in wastes which are at present abandoned to silence and solitude. Man would seem to migrate as well as the inferior animals, and it is possible that tribes may be dwelling in the mysterious inner zone between the Pole and the known Polar regions."

Well, our chapter on the Eskimo would have been read with interest by the author of this work. He shows every evidence of having an open mind, and we know that any scientists of today, who are as open to conviction as this writer evidently is, will eagerly embrace our demonstration that the so-called "pole" does not exist at all.

This author also refers to the presence of the "Arctic Highlanders" in the most inaccessible regions of the north and repeats their evidence that there are herds of musk-oxen frequenting lands far to the north situated in an iceless sea. He also refers to traces of these animals actually found by European explorers in Greenland, and also the presence of Eskimos who were met with by one captain and found by a later one to have gone north when the climate was so severe that their southern route was absolutely blocked.

The late Dr. Nicholas Senn, the well known Chicago surgeon, who is quoted in this book on the subject of the Eskimo, also corroborates the fact of birds migrating to the farthest north. He adds that even in cases of birds breeding in Greenland, the migration nevertheless takes place.

MORE ANIMAL LIFE THAN IN TROPICS

In J. W. Buel's "The World's Wonders"--in which there is a very comprehensive summary of the state of our knowledge of the Arctic regions we are told, "It is a fact that animal life is greater in the Arctic than in the tropical seas. Portions of the Arctic ocean are even colored by the abundance of small creatures that swim therein."

And Herman Dieck, in his "Marvelous Wonders of the Polar World," tells us of Lieutenant Lock-wood's frequent observations in the highest latitudes he attained with Schley. These observations included signs of foxes, hares, lemmings and ptarmigans. Hundreds of musk-oxen, too, were seen by Greely in Grinnell Land. In fact, Dieck goes so far as to say that as the explorers went north they found an "Arctic Paradise" and that the ever increasing fertility of the country would almost justify the acceptance of Symmes' "eccentric theory," as he calls it. Of course Symmes' theory was eccentric because it was merely a piece of speculation. It did not really account for the actual conformation of the earth. But at least Symmes had enough sense to be dissatisfied with the orthodox scientific theory of his day. And had Mr. Dieck known of the theory expounded in this book he could not have failed to see in the unanimous testimony of explorers that the further north you go the more animal life there is, a complete proof that there is in the far north a great asylum of refuge where every creature can breed in peace and with plenty of food. And from that region must come also those evidences of vegetable life

that explorers have 'epeatedly seen, the red pollen of plants that drifts out on favorable breezes and colors whole ice bergs and glacier sides with a ruddy tinge, those seeds and buds and branches, and, most impressive of all, those representatives of races of animals that yet live on in the interior although they have disappeared from the outside of the earth.

A PARADISE OF LIFE

What a veritable paradise of animal and vegetable life that must be! And perhaps for some sort of human life also it is a land of perpetual ease and peace. The Eskimo people who are probably still living there will have been modified from the type that we see on the outer surface. Their life will be easier, they will have no cold climates and food scarcities to contend with. Like the inhabitants of some of our tropical islands they will reflect the ease of their lives in easy-going and lovable temperaments. They will be hunters and fishers and also eaters of many fruits and other vegetable products unknown to us. When we penetrate their lands we shall find growing almost to the inner edge of the polar opening those trees of which we have seen so many drifting trunks and branches. We shall find, nesting perhaps in those trees, perhaps in the rocks around the inner polar regions the knots and swans and wild geese and ross-gulls that we have so often seen in the preceding pages, flying to the north to escape the rigors of climate which we in our ignorance have for so long supposed to be worse in the north than elsewhere.

We shall see all that when we explore the Arctic in earnest, as we shall easily be able to do with the aid of airships. And when once we have seen it we shall wonder why it was that for so long we were blind to evidence which, as is shown in this book, has been before men's eyes for practically a whole century and over.

CHAPTER XIII. OTHER INTERESTING ANIMALS OF THE INTERIOR

The mammoth and mastodon, while giving us our chief evidence that there is habitable land within the interior of the globe, are not the only animals which may be studied in this connection. There are records of other animals living in that land whose like has never been seen on any portion of the outside globe, only their fossilized or semi-fossilized remains telling their story.

OBSERVATIONS OF ANIMALS

Robert B. Cook, writing in *Knowledge* for 1884, tells of the remains not only of mammoths but of hairy rhinoceros, reindeer, hippopotamus, lion, and hyena, found in northern glacial deposits, and he claims that these animals, which are not able to endure cold weather, must either have been summer visitors during the severity of the glacial period or have been permanent residents while the country had--as he thinks--a milder climate. But as the reindeer, lion, and hyena are present day forms of life and not as old as the mammoth (at least in the form in which we know them today and in which these remains show them to have been when they were alive), it is evident that these animals visited the spots where their remains were found not from southerly climates during early glacial epochs, but that they are remains of visitors from the land of the interior. Otherwise these present day forms would not be found alongside those of the mammoth which we have shown to be a present day inhabitant of the interior of the earth. Not knowing this, Mr. Cook has great difficulty in explaining the occurrence together of these forms which in his view are earlier and later forms of life. But when we see that they are really contemporaneous the difficulty vanishes.

THE "ARCLA," A HITHERTO UNKNOWN ANIMAL

That some of the animal denizens of the interior world are species quite unknown to us will not seem at all strange when we think of the conditions that obtain there, and if that were the case it would not be so very strange if at

times a specimen of some kind of these unknown creatures wandered out over the lip, perhaps carried by a glacier, and was seen by some inhabitant of the far northern regions. As a matter of fact there is just such a case recorded by J. W. Buel in his survey of scientific and exploratory progress entitled "The World's Wonders". He quotes Captain Hall, who lived among the Eskimos for five years, who says that this and similar stories are worthy of credence because strange things that the Eskimos have told on other occasions have been verified afterwards.

It seems that the Eskimos often described to Captain Hall an animal which they, called the arcla: "but which is not mentioned in any book of natural history, nor did he ever see a specimen himself. . . ." The natives speak of this animal as being larger than the bear, and as very ferocious and as much more difficult to be killed. It has grayish hair, a long tail, and short thick legs, its forefeet being divided into three parts, like the partridge's, its hind feet are like a man's heels. When resting it sits upright like a man. A Neitchille Innuit, crawling into a hole for shelter, in the night, had found one asleep and quickly despatched it with his knife. It may be added here that Ebierbing, who was Hall's interpreter, now residing in the United States, confirms such accounts of the arcla, and says that the animal once inhabited his native country on Cumberland Sound.

CURIOUS ANIMALS IN THE FAR SOUTH

There is another curious fact that could be explained easily on the ground of our theory but that otherwise is very puzzling. When Nordenskiold was exploring the Antarctic regions he visited Patagonia, the most southern of inhabited lands. When there he explored a large cave in which he found a large piece of skin covered with greenish brown hair, and studded on the inner side with little knobs of bone. He identified it as the skin of a prehistoric animal called the mylodon, although along with the remains of the mylodon--for further exploration discovered no less than twenty specimens there were found many bones, teeth, and horny hoofs of a long extinct animal of the horse family, and as Mr. Edwin S. Grew says in his "Romance of Modern Geology" (where he recounts the episode), the whole thing is very puzzling (to the orthodox scientist, that is):

"It was supposed that the mylodon, like all the peculiar gigantic animals of

South America, had become extinct as long ago as the mammoth or as the wooly rhinoceros. All these extinct South American animals were distinguished by peculiarly shaped teeth, and had no teeth at all in front. They are called, therefore, Edentata, and their representatives today are much smaller."

THE MYLODON

So there is no doubt that the animal which Dr. Nordenskiold discovered was a prehistoric form. But on the other hand there was a very remarkable circumstance:

"The skin was dry but sound. When it was placed in water it gave out a smell which, though unpleasant was very interesting, for it showed that the animal which had worn it could not have been dead thousands or even hundreds of years. It was in fact, evidently a piece of the skin of a mylodon, which had survived in this region until modern times.

"Further explorations were made in the cavern by Dr. Moreno of La Plata, and other naturalists, and an immense quantity of bones was obtained, and more portions of the skin of the mylodon with the hair on. The cavern had been inhabited probably several centuries ago by Indians, for human bones and weapons were obtained.

"The remains of as many as twenty mylodons have been obtained from the cavern, and many of the bones are cut or broken in a way which leads us to suspect that the human inhabitants of the cave cut up the dead mylodons for food, and split their bones to obtain the marrow.

"Some of the mylodon bones, skulls, jaw-bones, leg-bones, etc., are smeared with blood and have pieces of cartilage and tendon attached. There are other evidences which go to show that the Indians may have kept the mylodons alive in the cave and fed them with hay brought from the outside.

"Besides the relics of the mylodon and of man the cavern has yielded bones and teeth, and many horny hoofs belonging to a kind of extinct horses; and this constitutes one of the puzzling things about this cave treasure . . . . . .

"The bones that were found are not buried in lime or any preserving stone;

but lie in sand where one would expect them to have perished long ago if they had been of any great age. Yet side by side with them are the bones of a long extinct horse; and there is no tradition among the Indians today of any huge beast corresponding to the mylodon. . . . . Possibly, though it does not seem very likely, the mylodon is still living in similar caverns in this region, as yet unvisited by man."

Now the above is very interesting in the light of our theory. The fact that the mylodon was not a relic of untold ages ago is beyond dispute: the relative freshness of its skin proves that, to say nothing of the fact that it was alive when Indians who knew how to domesticate animals were in the land--and that is very recent in the scale of time in which the mastodon and mylodon figure. But the fact that the bones of a long extinct horse-like animal were found alongside those of the mylodon, showing that the mylodon, an animal known to be very old and yet, in this case, proved also to be very recent, and the horse-like creature were contemporary. That means that the horse-like animal is not so old as we think.

Where, then, could either one of them have come from? Although the country has been explored since Mr. Grew's book was written no mylodons have been found as he suggests they might be. Evidently these were the remains of some specimens that in some way had wandered from the interior over the Antarctic polar lip and either through being caught on a floe or carried by a glacier they drifted on to some land which connects with Patagonia.

That the Indians, whose bones were found in the cave, died on the same spot as that in which they had lived and where they kept these animals, might almost prove that they were among the last of their kind. Otherwise as soon as their supply of food was exhausted these Indians would have gone forth in search of more and their bones would not have been found beside their banquet board.

AN ESKIMO TRADITION

It may be well to add at this point that the Eskimos have a well defined tradition that the mammoth lives underground. Two writers in the *Scientific American Supplement* independently make this assertion, and while the

Eskimos are wrong, of course, in thinking that a large animal like the mammoth could burrow like a mole, the very fact that they have this idea shows that they are accustomed to seeing the mammoth at intervals and then lose sight of it for some time, the animal suddenly appearing again. If we allow that the mammoth has its present habitat in the interior of the earth, it is quite easy to see how this idea arose.

CHAPTER XIV. THE AURORA

Every reader of this book has heard of the Aurora Borealis, or Northern Lights, and the Aurora Australis, or Southern Lights. Some readers may have visited Norway and gone far enough to catch a glimpse of this mysterious phenomenon. We say mysterious because scientists have never been able to explain it, although they usually try to do so by saying something indefinite about the earth's electricity and magnetism. We claim, on the basis of our theory, to explain definitely what causes the auroral lights: that the central sun, flashing its beams through the polar openings, is the cause. To enforce this claim we shall first describe. in the words of competent observers, just what these lights look like and how they behave. We shall then show--also on the best scientific evidence--that they are not and could not be caused by electricity or magnetism; we shall refute many fallacies on that subject. And then we shall give abundant evidence proving that the reflection of the rays of the central sun by the earth's atmosphere, modified by the conditions, cloudy or otherwise, of the atmosphere of the interior of the earth, is what causes these wonderful displays of light.

WHAT THE AURORA LOOKS LIKE

We shall have more than one description of the aurora in the following chapter, but perhaps it will be interesting to start our enquiry from a rather old but very good book to which we have referred before. In Honorable Daines Barrington's "Possibility of Approaching the North Pole" he asks a correspondent about the aurora and is assured that it "is commonly seen most strong in the north and is very red and fiery."

IS IT CONTINUOUS?

Greely in his "Three Years of Arctic Service" says a number of interesting things. He remarks that there is always a feeble auroral light even when there is not a brilliant display. Soon after that remark we find him observing a perfectly circular aurora which he calls a mock sun. It had burning colors of blue, yellow and red with bars of white. A few days after, he witnessed an

aurora which had a beautiful corona or crown of light around it. It had numerous and brilliant streamers. Then here is another description of an aurora:

"A beautiful and brilliant arch about three degrees wide, formed of twisted, convoluted bands of light, similar to twisted ribbons, extended from the south-west through the zenith to the north-eastern horizon. Occasionally, well-marked and clearly defined patches of light detached themselves, as puffs of smoke from a pipe, and drifted fading to the northwest.

The arch seemed to be continually renewing itself from the southwest to fade at the opposite end. Perhaps a better idea of this peculiar formation may be conveyed by likening the display to an arch having the appearance of an endless, revolving screw. This formation was by no means infrequent, but I have never seen it elsewhere or known it to be described."

Again Greely writes:

"A particularly fine aurora, like a pillar of glowing fire, from horizon to horizon through the zenith, showing at times a decidedly rosy tint."

It will at once strike the reader how well these observations fit in with our theory that the aurora is the reflection of the beams of the inner sun coming through the polar orifice, when he remembers the extraordinary differences there will be in the conditions which from time to time modify those reflections. There may be clouds between the inner sun and the polar orifice, and these may be diffused or in heavy dense masses. The atmosphere may be moister or dryer at one time than another and this will modify the reflections. The earth's outer atmosphere may vary as well as its inner one. Hence all the differences which are described in the succeeding pages.

NANSEN DESCRIBES AURORA

Let us now take the testimony of Fridtjof Nansen on the subject of the aurora. In "Farthest North" he describes many appearances of this marvel. Here is part of one of his descriptions:

"A lovely aurora this evening. A brilliant corona encircled the zenith with a wreath of streamers in several layers, one outside the other; then larger and

smaller sheaves of streamers over the sky. . . . . All of them, however, tended upward toward the corona, which shone like a halo. Every now and then I could discern a dark patch in its middle, at the point where all the rays converged. It lay a little south of the pole star, and approached Cassiopeia in the position it then occupied. But the halo kept smouldering and shifting just as if a gale in the upper strata of the atmosphere were playing the bellows to it. Presently fresh streamers shot out of the darkness out-side the inner halo, followed by other bright shafts of light in a still wider circle, and meanwhile the dark space in the middle was clearly visible; at other times it was completely covered with masses of light. Then it appeared as if the storm abated, and the whole turned pale, and glowed with a faint whitish hue for a little while, only to shoot wildly up once more and to begin the same dance over again. Then the entire mass of light around the corona began to rock to and fro in large waves over the zenith and the dark central point, whereupon the gale seemed to increase and whirl the streamers into an inextricable tangle, till they merged into a luminous vapor that enveloped the corona and drowned it in a deluge of light, so that neither it nor the streamers, nor the dark centre could be seen--nothing, in fact, but a chaos of shining mist."

OUR EXPLANATION

Now it is obvious that the real explanation of this phenomenon is to be found in those words which Nansen uses without seeing their real bearing on the problem: "it appeared as if the storm abated" and "the gale seemed to increase". As a matter of fact the light from the central sun was being reflected from the higher reaches of the earth's atmosphere and the reflection was interfered with by a violent storm in the interior of the earth. Clouds were rapidly being formed and being dissipated in that part of the interior near the polar, opening. Thus the rays of the central sun were one moment permitted to pass without obstruction; then the opening would be clouded up, at first perhaps by one dense cloud giving the central dark spot in the reflection of which Nansen speaks; then there would be a general filming over of the aperture and the result would be a diffused reflection.

Not only is it true that no other explanation fits the facts of the rapid changes without apparent cause, but Nansen himself acknowledges that he was quite ignorant of the cause of the phenomenon. He says:

"O thou mysterious radiance! What art thou and whence comest thou? Yet why ask? . . . . . What would it profit if we could say that it is an electric discharge or currents of electricity through the upper regions of the air, and were able to describe in minutest detail how it all came to be?"

NOT CAUSED BY ELECTRICITY

The reader will notice that Nansen does not commit himself to the popular view that the aurora is caused by electricity. In that he shows his wisdom, for we shall now deduce evidence to show that electricity has nothing whatever to do with the aurora.

If, as some people think, the earth's magnetism or electricity at the polar regions or around the earth's magnetic poles were the cause of the aurora, there would be a constant relation between its displays and the different instruments which have been constructed to tell the presence of magnetism and electricity--the compass would be affected and the electrometer would be affected. And there would certainly not be the irregularity about these displays that Nansen describes above. So now let us take the testimony of other observers. Payer who entered the Arctic circle on the "Tegetthoff" during the years 1872-1874, has a whole chapter devoted to the aurora. He says that it is very difficult to characterise the forms of this phenomenon, not only because they are manifold but because they are constantly changing. Sometimes there are brilliant bands and patches of light upon the sky, sometimes there are appearances like "glowing balls of light". He further says:

CLOUDS IN THE INTERIOR

"The movement of the waves of light gave the impression that they were the sports of winds, and their sudden and rapid rise resembled the uprisings of whirling vapors, such as the geysers might send forth In many cases the aurora much resembled a flash of summer lightning conceived as permanent".

Now that description precisely fits in with what we have described as the reflection of the light of the central sun, that light being by turns cut off in one part and then another, here and there a gleam breaking through, as the atmosphere of the interior changed. That the appearance was "the sport of

winds," as Payer says, is literally true, only the winds were those shifting the clouds in the atmosphere on the inner side of the polar orifice. And it may be noted that a magnetic display could not be the sport of winds, for wind does not effect the ether in which medium along magnetic lines of force and electrical light from discharges work. If the aurora were caused by electrical lines of force discharging themselves in light, it would not be so capricious as described above. It would be a more or less steady appearance.

WHAT PAYER HAS TO SAY OF THE AURORA

Payer goes on to say that often after a brilliant aurora there would be bad weather which certainly sounds as if the storm clouds from which it was reflected from the inner sun were breaking, or perhaps a storm starting in the interior was coming over the lip and running its course in the Arctic circle. He adds that none of the theories current at the time explain the phenomenon. He thinks, however, that vapors rather than electricity may play a part in the phenomenon, especially on account of its "indefinite form" which, as we have pointed out above, is only explicable on our showing that the aurora is the reflection of the central sun and not due to any electrical discharge. A member of Payer's expedition, Lieutenant Weyprecht, describes one form of the aurora as an arch of light, looking as if "it were the upper limit of a segment of a circle and it is often thrice the breath of a rainbow. Often as it rises other arches follow it, all rising toward the zenith." Now we know that a rainbow is caused by the sun that lights the earth, and it is only natural that when the conditions are calm the reflection of the inner sun should also take this form--the circularity of the arch of the aurora simply being the reflection of the circular outline of that inner sun's diameter. Payer quotes Parry as saying that there was no magnetic disturbance when the aurora was seen. He, himself, is not able to make any connection between variations of the magnetic instruments and the presence of the aurora, although he tries hard to do so. As the final result of his observations he writes as follows:

"No pencil can draw it, no colors can paint it, and no words can describe it in all its magnificence. And here below stand we poor men and speak of knowledge and progress, and pride ourselves on the understanding with which we extort from Nature her mysteries. We stand and gaze on the mystery which Nature has written for us in flaming letters on the dark vault

of night, and ultimately we can only wonder and confess that, in truth, we know nothing of it."

Now some day that will appear very pessimistic, for we are making progress in knowledge, and about this very subject. After the enthusiastic description which Payer gives of the beauties of the aurora, might it not have occurred to him that magnetic or electrical discharges could not produce such grandeur because electrical flashes are only bright when the electricity is at a very high tension. But as soon as the tension of the electricity in the atmosphere becomes great enough we have a thunder storm, and we all know just how bright the lightning flash is. But how about these marvelous colors, this sea of flames of which Payer says "is that sea red, white or green? Who can say?" And Payer admits that it is even impossible to tell whether the "rays shoot from above downward or from below upward." Such colors could not possibly be produced by electricity; they are the colors of the interior sun partly split up like the rainbow by their breaking up as they pass from stratum to stratum of the atmosphere at length to be reflected back to us.

But we have denied that these displays have any effect on the magnetic needle or the electrometer. Let us verify that assertion by evidence more powerful than Payer's. Greely says in the book from which we have already quoted that "it seems to be the experience here that the magnet is undisturbed during the prevalence of colorless auroras" although he did observe in a few cases he reports that magnetic storms took place at about the same time as there were auroral displays. In these cases, however, it is certain that the conditions which produced the stormy and colored appearance of the aurora due to its refraction through damp air--also produced the magnetic storms, just as in our own latitudes an electrical storm is accompanied by a great deal of moisture in the air. While in ordinary weather, the atmosphere being uniform throughout, the auroral reflection is uncolored because it is not broken up into a spectrum and at the same time in such uniformly dry air there is nothing to cause a magnetic storm. But it by no means follows, from the fact that Greely saw these magnetic storms upon one or two occasions, that they always accompany colored auroras, for as a matter of fact they do not, as our further testimony shows.

But there is one important preliminary point. If the aurora is a reflection of the inner sun, it will only be on the rare occasions when the whole polar

orifice is covered with cloud--and how rare such a condition would be, even in the damp atmosphere of the interior--that the aurora will be absent. The sun is always there, the orifice is always there, and the earth's atmosphere above the polar regions will always be dense enough to reflect some light, though not of course dense enough to reflect the wonderful lights that it sometimes does. So, if our theory be true, there ought always to be some auroral light at the pole. And we have the testimony of the celebrated French astronomer, Camille Flammarion, that this is so. In one place in his book, "The Atmosphere", he says: "Nearly every night there is a more or less brilliant display of these auroral lights". And later in the same book he says: "This light of the earth, the emission of which toward the poles is almost continuous. . . . . ."

NOTHING TO DO WITH MAGNETISM

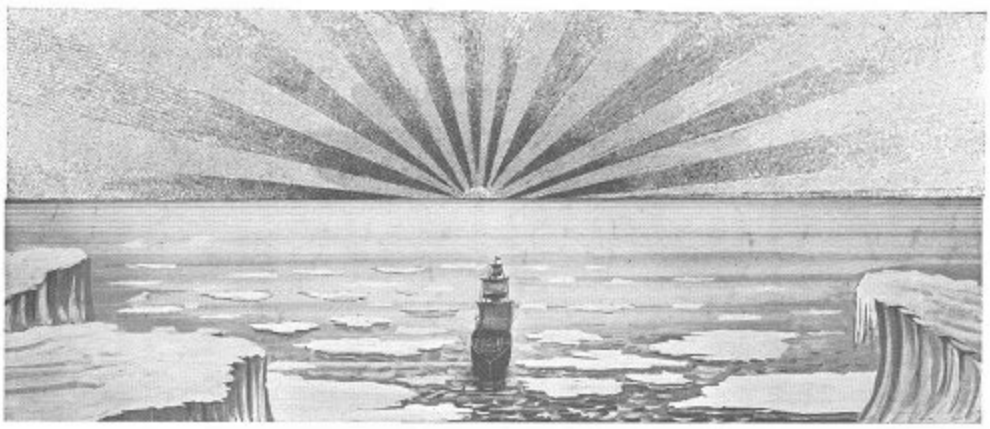
And now for the alleged disturbance of the magnet or other instruments. In Sargent and Cunning-ham's "Wonders of the Arctic World," which is a carefully written account of the earlier expeditions, it is recorded that during the Second Land Expedition of Franklin, enough observations of the aurora were made with specially designed instruments and recorded to establish the fact that no disturbances of the magnetic needle accompanied the displays. (Page 164.)

We may corroborate this testimony by referring to "Wonders of the Polar World", by Herman Dieck, M. A., another work in which the main results of polar exploration are summarized. Mr. Dieck quotes a description of an aurora seen by Greely's men, in which the arch form which we have already described was very prominent, and also the prismatic colors showing that the aurora was colored through the breaking up of sunlight, just as in the case of the rainbow. And he adds that there was no noise--this is important, as electrical discharges are always accompanied by a crackling noise--and there was no disturbance of the compass. Later, Lieutenant Greely set up an electrometer, an instrument which records the presence of very small amounts of electricity, but "to his astonishment" there was not a trace of electrical disturbance. Greely also noticed that there were no crackling sounds in connection with the display.

BRUCE ON THE AURORA

It is often the case that once the real explanation of anything is found out, we get corroborative evidence from the most unexpected sources, and the reader who turns to a very recent and most depend-able work in the Home University Library, that of William S. Bruce, leader of the Scottish National Antarctic Expedition, called "Polar Exploration", will find just such testimony. Professor Bruce says that the phenomenon occurs in other planets than our own and that it has been notably observed in Venus--which of course would be the case as the reader will remember that Venus occasionally shows us her central sun, and so we would naturally expect also to see its reflection in Venus' atmosphere. Professor Bruce also tells us that the early Norwegians held that the aurora was due to "fires which surround the sea to the north". Now that is very interesting because it suggests that perhaps these people had had in some way communication with the interior of the earth, and they might easily have thought that the central sun was some sort of fire. In fact some of them thought that the aurora was simply "a reflection of the sun when it is below the horizon" and that suggests that they had actually got far enough north to see the interior sun for a short time, perhaps, and that they afterwards saw its reflection in the sky in the form of an aurora, and remembering that they had just left the sun behind, they guessed that the two had this connection.

On the other hand, Professor Bruce quotes the observations of a British Antarctic Expedition to the effect that:



"The observations of atmospheric electricity taken during the displays

reveal no special effect due to the aurora."

There are some other considerations which show that the aurora is really due to the interior sun. Dr. Kane, in his account of his explorations, tells us that the aurora is brightest when it is white. That shows that when the reflection of the sun is so clear that the total white light is reflected, we get a much brighter effect than when the light is cut up into prismatic colors. In the latter case the atmosphere is damp and dense--that being the cause of the rainbow effect--and through such an atmosphere one cannot see so much. Hence the display is not so bright as it is when the atmosphere is clear and the light not broken up.

THE NEARER THE POLE, THE BETTER THE DISPLAY

Again, if the aurora is the reflection of the central sun, we should expect to see it fully only near the polar orifice, and see only faint glimpses of its outer edges as we went further south. And that is precisely what is the actual fact of the matter. Says Dr. Nicholas Senn in his book "In the Heart of the Arctics":

"The aurora, which only occasionally is seen in our latitudes, is but the shadow of what is to be seen in the polar regions."

And in "Earth, Sea, and Sky," by H. D. Northrop, we read:

"As we retire from the pole, the phenomenon becomes a rare occurrence, and is less perfectly and distinctly developed."

Regarding the two quotations just made a word of explanation is necessary. When Dr. Senn speaks of the aurora being only a "shadow" when it is seen some distance south he does not mean that it is a shade. He simply means that it is much fainter than when it is seen in the north. Now what is the reason of this? It is well known that certain laws of refraction of light cause a very bright rainbow to cast another rainbow, similar to itself at a distance from itself in the sky. Sometimes when the rainbow is very bright there is enough light being refracted so that two reflections are formed, and then the first reflection is paler than the original rainbow and the second reflection is still paler. Similarly, the auroral light is refracted in part so that a faint image of it or "shadow" is seen rather far to the south, sometimes as far south as the latitude of Illinois. But it is well known that no aurora or

reflection of an aurora is ever seen at the equator, and as the aurora which is seen some distance from the north is only a shadow or reflection of the real aurora it is only occasionally, when the atmosphere happens to be right for it, that we see this phenomenon.

THE DISPLAY IS CONTINUOUS

H. D. Northrop further notes that the light of the aurora is continuous during the Arctic night, and he says that the arch which we have already mentioned as being such a prominent feature of the aurora is only "part of a ring of light which is elevated considerably above the surface of our globe, and whose center is situated in the vicinity of the pole."

And that is precisely what we should expect when we remember that it is the reflection of the rays coming through the polar orifice which causes the phenomenon. Northrop points out that a person looking at this ring from a point very far north would imagine that the aurora was to the south of him simply because the ring was so far spread out overhead.

This point is corroborated by the author of "The Arctic World" who says the same thing about the aurora. Meanwhile we find that William Denovan in his scientific reference work, "The Phenomena of Nature", makes the statement that:

"In temperate regions the aurora does not present such grand forms as in the extreme north."

JUST LIKE THE SUN'S CORONA

The same author also makes another interesting point that supports our contention. It is that the corona or crown of light surrounding the sun is very like the light that the aurora gives us, and Nansen, in the second volume of his "Farthest North," speaks of an aurora in which there was a reflection that looked very like a corona. But, the reader may say, that is only a chance resemblance. It might be thought so, but exact observation confirms the idea that the light is the same in both cases. Taylor Reed, writing in *Popular Astronomy* for 1895, describes the spectroscopic observation of the sun's corona and compares the result with the examination of the earth's aurora. He

says:

"Both have their beautiful streams. Each has a characteristic form in the neighborhood of the pole of its sphere. Apply the spectroscope to each and the analogy is continued. Each gives in the spectrum an unidentified bright line, with fainter companions. Each shows a faint continuous spectrum.

We cannot imagine what further proof than the above anybody could need. If the two sorts of light give precisely the same spectroscopic appearances they must come from precisely similar sources. That is to say, if the corona is light caused by a sun, the aurora must also be light caused by a sun. And that is what we claim.

OBSERVATIONS BY EARLIER SCIENTISTS

Let us, before concluding, however, give one or two more citations to show that the evidence already adduced is not only to be had in isolated instances but is agreed with by all observers at all times. In the first place, verification of the fact that Greely obtained no results when he set up his electrometer during a display of the aurora when he was on his northern expedition, will be found in the interview which he gave the Associated Press and which was published all over the country and 'is to be found in the *Scientific American Supplement* for September 6, 1884. Again, Nordenskiold gave a correspondent of the *New York Herald* an account of his explorations in the Arctic in the course of which he made this very important announcement:

"Whenever the sky was clear, and there was no sun or moon, he saw constant in the northeast horizon, and almost always in the same exact spot, a faintly luminous arc so motionless as to be susceptible of accurate measurement. This phenomenon, Nordenskiold concludes, comes from an actual aureole, or ring of light, surrounding the northern portion of the globe."

It is notable that Nordenskiold also says that there were no very brilliant displays that year. Evidently the weather was calm, there were no storms to make rapidly changing reflections, and as the air in the interior was probably laden with moisture the display was not brilliant. But the fact it was circular and steady shows that it was a reflection of a body that was also circular and

steady, and reflected through a circular opening, and that body was no less than the interior sun.

It is interesting to note that the idea that the aurora is a reflection of sunlight is not confined to those old Norwegians we have spoken of. In an article translated from "La Lumiere Electrique" by the *Scientific American Supplement* for February 17, 1883, we are told that Descartes, Ellis, Frobisher, Franklin, Raspail and Wolfert, all thought that the aurora was from sunlight. They were near the truth, but they did not know what sun it really was that caused the light. In this same article we are told that the aurora is only seen at the pole and that any celestial light seen in the skies at lower latitudes---such as the zodiacal light is not due to the aurora at all.

In Nature, the volume of 1878, will be found an account of the eclipse of the sun as observed by the astronomer royal of Great Britain wherein it is stated that Professor Bass observed steadily for the whole period one part of the sun's corona, and he found that it pulsated in just the same manner as the aurora does.

THE AURORA AND THE ELECTRIC LIGHT CONTRASTED

And in conclusion we may repeat the observation of Payer, quoted also by W. J. Gordon in his book "Round About the North Pole", that it is impossible to discover whether the rays of the aurora shoot upward or downward. If those rays were electrical discharges they would all be going in the same direction, like the lines of force from a magnet. But the very fact that these rays are confused and seem to go now one way and now another, shows that they are light reflections which cross one another and appear and disappear as the reflecting surface--the upper layers of the atmosphere--varies. Thus we have one more item of the cumulative proof that the aurora is not a magnetic or electrical disturbance but simply a dazzling reflection from the rays of the central sun. And our next task is to see if there are not evidences of life in the land that is warmed by that sun. For if it warms continents and waters in the interior of the earth, if, as we have seen, birds have their feeding and breeding grounds there, if an occasional log or seed or pollen like dust is seen in the Arctic that come from some such unknown place as we have described, it

ought to be possible to obtain enough evidence of such life as would prove up to the hilt the contention of this book.

CHAPTER XV. THE ESKIMO

Throughout this book there have been many references to the Eskimos who live nearer to the north polar orifice of the earth than any other people but who are not found near the south polar orifice. Of people in that region, people who in our opinion undoubtedly were Eskimos we shall have something to say in the next chapter. Or rather we will let other people say it--for the finding of people in the Antarctic was a unique occurrence which has never been explained before. It has simply been recorded and wondered at. Ours is the only explanation, and this chapter is the necessary preparation for that explanation. The question that this chapter will answer is, "Who are the Eskimos and whence do they come?" That it is necessary to pose the question is shown by what Nansen has to say on the subject. For Nansen tells in the second volume of his authoritative work, "In Northern Mists," all that has been previously discovered about the Eskimos and one is astonished to see that it all ends in a question mark. In other words only a little is known about the Eskimos, and as to their origin nothing is known.

NANSEN ON THE ESKIMO

And yet the Eskimo must have come from somewhere to his present habitat, for as Nansen says "his world is that of sea-ice and cold, for which nature had not intended human beings"--implying, of course that the Arctic regions were not the original home of this race.

He goes on:

"As men of the white race pushed northward to the 'highest latitudes' they found traces of this remarkable people, who had already been there in times long past; and it is only in the last few decades that anyone has succeeded in penetrating farther north than the Eskimo, partly by learning from him or enlisting his help. In these regions, which are his own, his culture was superior to that of the white race, and from no other people has the arctic navigator learned so much.

A PUZZLE

"The north coast of America and the islands to the north of it, from Bering Strait to the east coast of Greenland, is the territory of the Eskimo. . . . . Within these limits the Eskimos must have developed into what they now are. In their anthropological race-characteristics, in their sealing and whaling-culture, and in their language they are very different from all other known peoples, both in America and Asia, and we must suppose that for long ages, ever since they began to fit themselves for their life along the frozen shores, they have lived apart, separated from others, perhaps for a long time as a small tribe. They all belong to the same race; the cerebral formation, for instance, of all real Eskimos, from Alaska to Greenland, is remarkably homogenous; but in the far west they may have been mixed with Indians and others, and in Greenland they are now mixed with Europeans. They are pronouncedly dolichocephalic; but have short, broad faces, and by their features and appearance are easily distinguished from other neighboring peoples. Small, slanting eyes; the nose small and flat, narrow between the eyes and broad below; cheeks, broad, prominent and round; the forehead narrowing comparatively above; the lower part of the face broad and powerful; black, straight hair. The color of the skin is a pale brown. The Eskimos are not, as is often supposed, a small people on an average; they are rather of middle height, often powerful, and sometimes quite tall, although they are a good deal shorter, and weaker in appearance, than average Scandinavians. In appearance and also in language they come nearest to some of the North American Indian tribes."

VERY LIKE THE CHINESE

We shall find later, however, that other observers think the Eskimos are nearer in type to the Chinese than to any other race.

Nansen admits that he is puzzled--in common with other enquirers, no two of whom agree--over the origin of the Eskimo race. The central point of their culture, he says, is seal-hunting, "especially with the harpoon, sometimes from the kayak in open water and sometimes from the ice. We cannot believe that this sealing, especially with the kayak, was first developed in the central part of the regions they now inhabit; there the conditions of life would have been too severe, and they would not have been able to support themselves until their sealing culture had attained a certain development. Just as in

Europe we met with the 'Finnish' sea-fishing on a coast that was connected with milder coasts further south, where seamanship was first able to develop, so we must expect that the Eskimo culture began on coasts with similar conditions. . . . . ."

Dr. Nansen then discusses the various possible mild coasts on which the Eskimo might have learned his sealing and navigation, but he cannot come to any satisfactory conclusion and says that the question will have to be left open.

The fact that the question cannot be settled in any other way naturally impresses us with the probability that it will be settled through the application of our theory. The coasts near the polar orifice on the inner side of the earth would afford the ideal conditions for the earliest habitat of the Eskimo race, and, as we shall see later, there are other facts which make us certain that the Eskimo race as we know it today is an overflow from settlements on the borders of the polar orifice. Not only shall we show later that there has actually been communication between the Eskimos of the north and the Antarctic region--we shall show that that uninhabited part of the world has been visited by Eskimos or similar people coming through the interior of the earth--but many things in Eskimo history and tradition point to their coming from the interior.

THEY CAME FROM THE NORTH

First, however, let us note that Nansen lists quite a number of scientists all holding "various views as to the origin of the Eskimo", which, however, are all different from the idea set forth by Nansen that they must have come from a milder climate than their present one. Nansen notes that on the American Arctic islands the Eskimos no longer live as far north as they once did--as where older traces of them are found. It is evident in this case that they began north and gradually made their way south. But that beginning was not only north but was in the interior. And in many other cases we shall see that the farther north one goes the more one sees traces of Eskimos and we shall also find it true that all their traditions point to the north, and even to a condition of things which can only be explained on the theory that they once lived in a land of perpetual sunshine--which the interior of the earth is.

As further illustrating scientific ignorance about these people, we may see further what Nansen has to say:

HOW THEY TRAVEL

"How early the Eskimo appeared, and came to the most northern regions, we have as yet no means of determining. All we can say is that, as they are so distinct in physical structure, language and culture from all other known races except the Aleutians, we must assume that they have lived for a very long period in the northern regions apart from other peoples. It would be of special interest here if we could form any opinion as to the date of their immigration into Greenland. It has become almost an historical dogma that this immigration on a larger scale did not take place until long after the Norwegian Icelanders had settled in the country, and that it was chiefly the hordes of Eskimos coming from the north that put an end, first to the Western Settlement and then to the Eastern. But this is in every respect misleading, and conflicts with what may be concluded with certainty from several facts; moreover, the whole Eskimo way of life and dependence on sealing and fishing forbids their migration in hordes; they must travel in small scattered groups in order to find enough game to support themselves and their families, and are obliged to make frequent halts for sealing. They will, therefore, never be able to undertake any migration on a large scale."

The above strengthens our position very materially, for all the migrations of peoples with which history deals have been on a large scale, whole tribes staying together and moving in concert along definite routes. But if the Eskimos had come to the north from more southerly climates or even if they had come from so far away as China, or from the wilds of North America, they must either have come up all together--which Nansen tells us is impossible--or they must have scattered themselves over a much wider territory than they now occupy. In other words large numbers of them have become "lost" as far as any particular route is concerned. Nansen gives a map of their present and past distribution in his book, and it practically proves alone, without further evidence, that the Eskimos came from the north, for they only occupy the north coast of America, and the islands to the north of it, from Behring Strait to the east coast of Greenland, and that marks the limit of their territory. Now how could small groups at different times, starting out

at points far away from this, all converge to that one small field of distribution? Why did not many of them stop at favorable parts on the way? Why did they not mix with and modify other tribes whom they met on the way, leaving traces that the anthropologist could note and trace down? No, the map of the distribution of the Eskimos shows that they came from the north, from over the lip of the polar orifice, and settled upon the first suitable land that they reached.

That the Eskimos left the interior of the earth very early perhaps when the northern climate was milder than it is now and therefore more attractive to them--seems probable. Nansen says:

"There can be no doubt that the Eskimo arrived in Greenland ages before the Norwegian Icelanders. The rich finds referred to among others by Dr. H. Rink, of Eskimo whaling and sealing weapons and implements of stone from deep deposits in North Greenland show that the Eskimos were living there far back in prehistoric times."

And in a note appended to this statement Nansen adduces evidence to show that in those prehistoric times the Eskimos lived more to the north than they do at the present time--a very significant thing to admit, seeing that it points to a northern and not a southern origin and starting point.

But the Eskimos had learned a number of things, that is to say they were not a new tribe emerging from savagery but had a history behind them, when they did take up their abodes on the northern shores of the outer world. Nansen remarks that they: "must have had at the time of their first immigration much the same culture in the main as now, since otherwise they would not have been able to support themselves in these northern regions."

THEIR MEANS OF TRANSPORTATION

He further tells us that:

"Their means of transport were the kayak and the woman's boat in open water, and the dog-sledge on the ice. Their whaling and sealing were conducted in kayaks in summer, but with dog-sledges in winter, when they hunted the seal at its breathing-holes in the ice, the walrus, narwhale and white whale, in the open leads, and pursued the bear with their dogs. In

winter they usually keep to one place, living in houses of stone or snow, but in summer they wander about with their boats and tents of hides to the best places for kayak fishing."

That sounds as though it were the pursuit of seals, whales, etc., which gradually brought the Eskimos out of the interior polar regions into those of the exterior in the first place, and as Nansen goes on we see that he constantly emphasizes the fact that they moved further south. And although it was more temperate after they had passed the very cold region which is just south of the polar inland sea, they "no longer found the same conditions of life as before, the ice was for the most part absent, the walrus became more difficult in the open sea, and winter fishing from the kayak was not very safe."

POORER HUNTING IN THE SOUTH

That quotation answers any reader who may wonder why the Eskimos emigrated from the interior in the first place, where the climate is mild, out into the regions of North Greenland where it is harder. The answer is that the Eskimo is by nature a hunter and fisher, just as some tribes of the earth are naturally agricultural and stay fixed in one spot while others are nomads and roam. The Eskimos were hunters and fishers of whale, narwhale, seal, etc., and they pursued their prey gradually over the polar lip. As long as they had sought these creatures in open water they had great difficulty in catching them. When they came to an ice-bound region, which they would do after they had come down past the region of warm currents and open sea around the poles, they found it easier to catch their prey. When they went too far south, so that the sea became warm and open again, they could no longer do this so easily, and so, as Nansen points out they remained in the localities where the winter meant ice:

"Southern Greenland, therefore, had no great attraction, so long as there was room enough further north."

In other words the Eskimo who came too far south found out what we have seen that the polar explorers from our own countries found out--a greater abundance of life further north.

That the Eskimo came from the interior of the earth, that is to say, from a

location which they could not easily explain to the Norwegians who might have asked them where they originally came from, is shown by the fact that the early Norwegians regarded them as a supernatural people, a species of fairy. When we remember that in the efforts of these Eskimos to tell where they came from they would point to the north and describe a land of perpetual sunshine, it is easy to see that the Norwegians who associated the polar regions with the end of the world, certainly not with a new world, would wonder at the strange origin thus indicated. They would. naturally assume that these were supernatural beings who came from some region under the earth--as that was always considered to be the abode of fairies, gnomes, and similar creatures.

EARLY NORWEGIAN IDEAS ON THE ESQUIMAUX

And according to Nansen this is precisely what happened. He says:

"I have already stated that the Norse name 'Skraeling' for Eskimo must have originally been used as a designation of fairies or mythical creatures. Further-more there is much that would imply that when the Icelanders first met with the Eskimo in Greenland they looked upon them as fairies; they, therefore, called them 'trolls,' an ancient common name for various sorts of supernatural beings. This view persisted more or less in after times. Every European who has suddenly encountered Eskimos in the ice-covered wastes of Greenland, without ever having seen them before, will easily understand that they must have made such an impression on people who had the slightest tendency toward superstition. Such an idea must, from the very beginning, have influenced the relations between the Norsemen and the natives, and is capable of explaining much that is curious in the mention of them, or rather the lack of mention of them, in the sagas, since they were supernatural beings of whom it was best to say nothing."

Nansen then goes on to tell us that when these Skraelings were mentioned in Latin writings the word was always translated by "Pygmaei" which meant "short, undergrown people of supernatural aspect"--that is like fairies; and it was precisely that sort of being who had always, in the middle ages and as far back as classical times, been supposed to inhabit Thule--Thule being the ultimate land beyond the north, being in fact, no doubt a conception really based on what is the actual fact, as proved in this book. It is seldom that there

is not a basis in fact for the myths and ideas of antiquity, and this belief in a land beyond the poles inhabited by a strange people was very widely distributed. In fact Nansen tells us that from St. Augustine the knowledge of these pygmies "reached Isidore; and from him the knowledge was disseminated over the whole of mediaeval Europe partly in the same sense, that of a more or less fabulous people from the uttermost parts of the earth; and partly in the sense of a fairy people. Supported by popular belief in various countries, the latter meaning soon became general. Of this Moltke Moe gives a remarkable example from the Welshman, Walter Mapes (latter half of the twelfth century) who in his curious collection of anecdotes, etc., (called 'De Nugis Curialium'), has a tale of a prehistoric king of the Britons called Herla. . ."

EARLY NORWEGIAN LEGENDS

Nansen then goes on to repeat the tale which represents this king as meeting with Skraelings or Eskimos, and being taken by them beneath the earth. Of course in the form in which it is given by this Welsh-man of the twelfth century it is only a fairy tale. But may there not be a basis in truth for such a tale? It is remarkable how many early legends represent people as going under the earth or into an utterly strange realm, and when we remember what feats of navigation the early Norsemen could perform--we must remember that they first discovered America it looks as if they might have penetrated to the interior and so made a basis in fact for these very frequent tales of people finding a supernatural realm and staying there for a long time but at last coming back. In this connection we may mention the fact that the early Irish had a legend of a land far beyond the sea where the sun always shone and it was always summer weather. They even thought that some of their early heroes had gone there and returned--never to be quite satisfied with their own country again.

A thirteenth century Norwegian authority is quoted by Nansen to show that the Eskimos were known then as a supernatural people, small in stature, who "have a complete lack of the metal iron; they use the tusks of marine animals for missiles and sharp stones for knives."

And Nansen adds:

"The curiously correct mention of the Skraelings' weapons must be derived from a well-informed source, and the statement established the fact that the Norsemen met with the Eskimos of Greenland at any rate in the thirteenth century."

We may also add that the fact that the Norsemen knew them as well as this and yet thought that they were supernatural people who "when these are struck while alive by weapons their wounds turn white without blood"--the fact that they really knew them and yet had ideas like that about them, shows that they did not regard them as ordinary human beings. And only the fact that the Eskimos came from some strange land, thought to be supernatural, would account for such strange ideas being held.

The early Norsemen did, however, wonder where these people could possibly come from, and Nansen tells us that whenever they went north they took particular notice of any abandoned Eskimo dwellings that they might happen to see. He says further:

"In an account of the voyage to the north, about 1276, we read that at the farthest point north there were found some old Skraeling dwelling places, while farther south, on some islands, were found some inhabited ones. In agreement with this it is stated of the men who came from the north in 1266 that they saw no 'Skraelingja vistir' (dwelling places) except farther north than in Kroksfjardarheidr, and therefore it is thought that they must by that way have the shortest distance to travel wherever they came from. Thus we see that the Skraeling? were found in and in the neighborhood of Kroksfjord but on the other hand not in the extreme north where only old sites left by them were found."

THESE IDEAS ARE SIGNIFICANT

In other words, one first met the Skraelings, then as one went farther north one met their deserted dwellings, showing that their progress was from the direction of the north. And Nansen adds in a footnote that these ancient observations are quite in conformity with later researches and therefore to be given full credence.

TRACES FOUND AT SEA

Nansen also gives us another remarkable fact, a piece of direct evidence of the Eskimos' having lived in the interior of the earth. He mentions the finding "out at sea" in 1226 of "pieces of driftwood" shaped with "small axes"--which he thinks may mean stone axes--and adzes (the Eskimo form of axe) and these pieces of wood had "wedges of bone imbedded in them."

Now we have already seen that driftwood from the interior of the earth is a common phenomenon in the Arctic regions. That they were not from a point near land is shown by the fact that the Norwegians who found them were much impressed and spoke of them in a way which showed that they thought the discovery something very much out of the common and something "not due to Norsemen."

Nansen also quotes an archbishop in 1520 who refers to the Eskimos as being very unlike other peoples, coming, as he says, from "the north-northwest of Finmark" and he seems to think that they live in underground houses--which again may be a reminiscence of the idea of their living under the surface of the earth or in its interior.

FRESH IMMIGRATION FROM THE NORTH

And Nansen also says that these Eskimo settlements were not only increased by the tribe growing but by "fresh gradual immigration from the north"--which clearly points to further additions from the interior of the earth.

That the present day Eskimo is not quite like the type described above, Nansen attributes to Scandinavian intermixture after Norwegian communication with the Greenland colonies had been cut off in the fourteenth century--due to internal troubles in Norway--and the larger race had been forced to amalgamate with the smaller Eskimos from whom they had previously kept aloof. So the Eskimo race as we know it today is not the same in physical appearance as the race that ordinarily came out of the interior of the earth.

DR. SENN ON ESKIMO AND CHINESE LIKENESS

We have mentioned that the Eskimo has been compared in appearance and type to the Chinese. The authority who does this is the late Dr. Nicholas

Senn, professor of surgery at the University of Chicago, who has made an Arctic trip and written some very interesting things about it. He says:

"The Mongolian type of the Eskimo is pronounced" and again: "The affinity of the Eskimo for the Chinese was well demonstrated by the actions of a little Eskimo girl that Mrs. Peary took home with her in 1894. The first thing that attracted her serious attention was a Chinaman she saw on the street, while the many new things she saw in the great city of New York that usually interest children made little impression on her."

Now it is quite possible that the Eskimos are not descended from any tribes driven out of China as that might imply, but that the Chinese as well as the Eskimos originally came from the interior of the earth.

ESKIMOS HAVE OWN IDEA OF ORIGIN

That they originally came from a land of constant sunshine, from a country away past the northern ice-barrier is the tradition of the Eskimos themselves, and it is a tradition which must be given full weight, for it could not have arisen among them in the first place without good cause. On this point Dr. Senn says:

"When questioned"--as to the land of their origin--"they invariably point north without having the faintest perception of what this means."

Naturally the Eskimos do not know that the earth is hollow and that ages ago they lived in its interior, but they have clung to that one simple fact--they came from the north. Dr. Senn denies that they have any characteristics in common with the North American Indian and thinks that they are the remnant of "the oldest inhabitants of the western hemisphere." In this attributing of great antiquity to them he may be right--at least he there agrees with Nansen. But the interior of the earth and not the western hemisphere is evidently the place of their original abode.

THEIR FAITH IN THIS ORIGINAL HOME

As for the land of perpetual sunshine, the Eskimo, of course, does not remember that as something he himself has seen, for it is very questionable if

any of the Eskimos of the present generation have ever penetrated to the interior. But it is a well known fact that every race has its idea of a "golden age" or paradise which is generally composed of the elements which are handed down in its stories and myths as being characteristic of its earliest home. Thus the Eskimo legends handed down generation after generation, tales of the interior land with its ever shining sun, and what could be more natural than when the Eskimo came to build in fancy a paradise for himself and his loved ones after they should die, that he should reconstruct this first home of which he had heard only in dim legends? That, at any rate is just what he has done. Dr. Senn, discussing their religion, says:

"They believe in a future world. . . The soul descends beneath the earth into various abodes--the first of which is somewhat in the nature of a purgatory: but the good spirits passing through it find that the other mansions improve till at a great depth they reach that of perfect bliss, where the sun never sets, and where by the side of large lakes that never freeze, the deer roam in large herds and the seal and the walrus always abound in the waters."

That paradise might serve as almost a literal description of the land in the interior of the earth, and the way in which the Eskimo indicates a preliminary purgatory before it can be reached may well be the reflection of a memory handed down in the tribe of the great hardships and difficulties of the ice barrier between that wonderful home and the present situation of the Eskimo on the southern side of that great natural obstacle.

It is also interesting to note that when the Eskimo first saw Peary's effort to get further north than the great ice-cap of Greenland beyond which they themselves had no ambition to explore--they immediately thought that the reason for his trying to get further north was to get into communication with other tribes there. That idea would hardly have occurred to them if it were not for the fact that they had traditional or other evidence of people in the supposedly unpopulated north.

With such a weight of evidence all pointing one way it is very hard to resist the conclusion that in the Eskimo we find a type, changed now and mixed with other types, but still something of a type of human being that has inhabited or very likely still inhabits the interior of the earth. We can certainly find no origin for them that explains their present situation. And

their legends admit of no other explanation either. For those legends certainly point to the same sort of land as every chapter in this book has pointed to--a land of perpetual sun and mild climate, a land corresponding to the "Ultima Thule" of ancient legend and that may sooner than the skeptic expects, be opened up once more to those who go properly equipped to seek it.

CHAPTER XVI. EVIDENCE IN THE ANTARCTIC

The Antarctic has not been so thoroughly explored as the Arctic polar region, and so our evidence from that end of the globe is not so voluminous, but it is startling in its conclusiveness. One point, in fact, will doubtless be admitted by the reader to be almost as distinct a proof of our theory as was the occurrence of the mammoth in Siberia in a perfectly fresh condition.

A GAP IN SCIENTIFIC KNOWLEDGE

Before coming to this startling direct evidence, however, let us briefly show how scientists themselves, in their effort to explain the evolution of the higher mammals, are driven to suppose the existence of a lost continent upon which a number of "missing links" between different grades of animal species would be found were that continent ever discoverable. As these scientists had no conception of a continent on the interior surface of the earth they were driven to suppose that during certain stages in the evolution of life this continent moved about on the earth's surface by the tilting up of one coast line above the waves while the other coast line was gradually submerging. This ingenious idea was put forward by Huxley. Other scientists thought that there was a vast Antarctic continent, but if the polar regions were the solid ice that scientists supposed this continent could not have produced the species that the scientists claim lie hidden--that is in fossil form--somewhere, nor could migration have taken place to other climes.

A POSSIBLE LOST CONTINENT

To show how important this is let us quote from an article in the *Scientific American Supplement* for October 8, 1892, by Dr. E. Murray Aaron. It seems, according to him that there is a gap in evolution between the animals of the Mesozoic era and the higher mammals, the placental mammalia as they are called, including the apes, cats, dogs, bears, horses, and oxen. From the Mesozoic forms to these forms is a big jump and one that is apparently very suddenly made. But how did these higher forms evolve? They could not have

come full fledged upon the earth for nature never takes such a big leap. The opponents of evolution make the best of this gap and challenge the evolutionists to fill it. Obviously there must have been some intermediate forms, and the question is, where did they live and where are their remains to be found. Dr. Aaron proceeds:

SHIFTING THE GARDEN OF EDEN

"Huxley's 'Lemuria,' a vast continent long lost beneath the water of the Pacific, the original 'Eden' of many latter day ethnologists, may be the region whose subsidence has buried its much sought for treasures beneath fathoms of water, but, however that may be, the discovery of new forms of animal and plant life and the discovery of fossil remains as already pointed out, cannot fail to shed a flood of light upon this, one of the most engrossing problems of the study of geographical distribution as it effects organic evolution. In fact, already is enough known of the material derivable from the Antarctic region to warrant Mr. Blanford, in a recent address before the Geographical Society of London in stating that 'a growing acquaintance with the biology of the world leads naturalists to a belief that the placental mammalia and other higher forms of terrestrial life originated during the Mesozoic period still further to the southward--that is to say, in the lost Antarctic continent.' . . ."

The author then quotes from a paper on Antarctic exploration read by Mr. G. S. Griffiths, F. G. S., before the Bankers' Institute of Australasia--who had himself quoted the above words--to the effect that:

A COMMON BIRTHPLACE

"It almost necessarily follows that wherever the mammalia were developed there also man had his birthplace, and if these speculations should prove to be well founded we may have to shift the location of the Garden of Eden from the northern to the southern hemisphere."

And Dr. Aaron adds:

"What a vista of results even to the production of fossilized primitive man and his immediate predecessors and the harmonizing of this corrected geological account with the Mosaic cosmogony, would open up, it may be

left to the imagination of the reader to conjecture."

The paper by Mr. Griffiths which Dr. Aaron refers to above was printed in *Nature* late in the year 1890 and from it some other interesting particulars may be gained. He says that if there were not such a continent as the one he supposed to have been lost there would not have been any chance for the migration of the animals and plants which are now found on such widely separated parts of the globe as South Africa and Australia. He says:

"We are told by Professor Hutton of Christchurch that forty-four per cent of the New Zealand flora is of Antarctic origin. New Zealand and South America have three flowering plants in common, also two fresh water fishes, five seaweeds, three marine crustaceans, one marine mollusk and one marine fish."

He then cites a number of other instances where widely separated lands have the very same species of animals, fish and plants:

"Yet the lands which have these plants and animals in common are so widely separated from each other that they could not possibly now interchange their inhabitants. Certainly toward the equator they approach each other rather more, but even this fact fails to account for the present distribution. . . Yet there must have been some means of communication in the past and it appears certain that it took the form of a common fatherland for the various common forms from which they spread to the northern hemisphere."

THE INTERIOR OF THE EARTH FULFILLS THIS CONDITION

We claim that this common fatherland is none other than the interior of the earth which by its warmth and luscious vegetation--remember that its sun is shining all the time and evaporating the water to form a very damp atmosphere--is just adapted to those large forms of life that hold the missing links spoken of above. By drifting from this common land on glaciers and icebergs these animals were gradually distributed.

A GREAT MYSTERY THAT ONLY OUR THEORY WILL

SOLVE

That this distribution is perfectly possible and may still be going on to some extent, is proved by the fact that an Antarctic voyager some years since saw a large iceberg covered with earthy matter, rocks and stones, showing that it came from land and not from barren ice as the orthodox scientists would have us think covers the polar regions.

But there was something else on this iceberg and it forms such a remarkable proof of our theory that it alone might have suggested some such theory as ours to anyone who pondered it sufficiently. Before stating the facts which form such a mystery to the scientist let us remind the reader that while the Arctic regions are inhabited by the Eskimos of whom we have already read, there have never been discovered any traces of human life either near or within the Antarctic circle. Penguins and seals and fish practically are alone in those regions. No Antarctic explorer has ever met a native tribe or put up for the winter in a native village. Man in the Antarctic is an unknown species.

How then does the reader explain the facts in the following statements taken from the nautical magazine for 1893. The statements occur in the course of an article devoted to reports of icebergs in the Antarctic seas:

"The Gladys, Captain E. B. Hatfield, . . . was completely embayed by icebergs (43 degrees S., 33 West) and did not get clear of fog and ice until July 4 in 40 degrees South, 30 West. At four p. m. of the latter date, signs of human beings having lived for some time on one of the icebergs in sight were well in evidence. On the northwest side was a beaten track, a place of refuge formed in a sheltered nook on the summit, and apparently five dead men lay on different parts of the berg.

"There were no indications of life, but the wicked weather precluded any attempt at further search and the Gladys was kept on her course."

Now let the reader remember two things. Dr. Cook, surgeon to the Belgian Antarctic expedition, writing in the Scientific American Supplement for June 23, 1900, gives the unanimous scientific verdict when he says that:

FROM WHERE DID THESE HUMAN BEINGS COME?

"Indeed in the great sweep of the earth's surface, which surrounds the south pole and extends far northward into the temperate zone comprising one quarter of the entire terrestrial area, there has not been found the footprint of man."

And let the reader remember also that these were no shipwrecked sailors, for the iceberg was coming from the south at the time; subsequently inquiry did not reveal the loss of any ship in the Antarctic prior to this discovery; and if these had been civilized men cast astray they would have put up a flag or some similar signal.

Other ships in this vicinity sighted icebergs with sand and earth on them proving that they came from a land source. And it was undoubtedly from this land source that this berg, which had earth on it as well as the five dead men, came. But, the reader says, you have just quoted an authority to prove that there are no men resident in the Antarctic regions. Where, then, did these five unfortunate castaways come from? From the interior continent the other side of the southern polar orifice, and we have no doubt that the Eskimos and these men are connected. For the Eskimo has not been able to leave his northern home and come south on the outside of the earth because that involved navigation in ships. But on the inside of the earth there is a milder climate and a different land formation, and there would be nothing to prevent such of the Eskimo tribes as penetrated over the northern Arctic lip, or what is more likely were born there from where they emigrated to the outer surface through the north--there is nothing to prevent them, we say, from going south along the interior surface of the earth and coming to the other polar orifice and out over it into the inhospitable Antarctic regions whence they drifted on this iceberg to the place where they were seen by Captain Hadfield.

As a speaker before the Sixth International Geographical Congress held in London, Mr. C. E. Borchgrevink, said, after reciting the discovery told of above:

"This earthy matter, rocks and stones, together with signs of human life, all found upon one of these visitants from that unknown region; this is surely a strong presumption in favor of the existence of races that answer to the Eskimos of the north."

A RACE LIVING IN THE INTERIOR

Yes, we reply, it is a strong presumption, but it is not a presumption that these races live on the exterior of the planet, for they have never been met with. But the presumption is that they live in the interior or at least that they have visited that part of the interior from time to time.

This same scientist also stated that on his own voyage to the Antarctic he noted that many of the seals had remarkable scars upon their bodies which indicated that they had been hunted. But no hunters from the north had been in that neighborhood and there was no seal industry. Is it not possible that tribes in the interior corresponding to the Eskimo of the north had hunted these seals?

Altogether the reader must admit that this evidence from the Antarctic is very important. Only such a land as we describe within the interior of the earth will relieve the scientists of their puzzle in explaining the distribution of animals. Only such a land makes it possible to explain the character of the earth-covered icebergs seen in those southern regions, and only such a land with a clear communication with the north through the interior of the earth makes it possible to explain the presence of those five dead men slowly traveling from the extreme south from a region which all the scientists told us does not give shelter or food to any human beings.

CHAPTER XVII THE JOURNEY TO THE EARTH'S INTERIOR

Having actually established the facts in the case we shall, in this chapter, use those facts in an imaginative and constructive way to show the reader what an actual journey into the interior of the earth would be like. We shall not invent any new facts or "make up" any mere tale of fancy, but we shall simply use the facts we have already gathered in a new way, grouping them together in the order in which an actual traveler would observe them.

ON AN EXPEDITION, WHAT SHOULD WE SEE?

In the first place, if the writer of this book and a company of readers were setting off on this expedition, we should take with us not only the usual equipment of an Arctic explorer but we should also provide for travel in very warm regions, for we know in advance that we are going to find a very warm and damp climate after we have braved the rigors of the cold weather to be found before we get to what are usually called the polar regions. And we should take more instruments for scientific observations than have usually been taken on polar explorations because we know from the experiences of former explorers how difficult it is to make the ordinary observations in the northern regions, and how important it is that everything possible be noted and compared with those observations which have already been made. We should not only have the ordinary instruments of navigation but delicate apparatus for making observations. When the auroral light was shining we should use a spectroscope to analyse it, and show that it was really the same as sunlight in its composition. We should have microscopes for examining botanical and biological specimens. And we should certainly have a trained geologist along, for we should wish his expert observations on the geology of the interior.

OUR START

Thus equipped we should leave some northern port, we may suppose it to be St. Johns, Newfoundland. In a little over a week we have arrived at

Godhaven, Greenland. Here we would pick up a number of Eskimo helpers, some sleds and dogs, and other necessities for the voyage. We would then proceed up the coast of Greenland to about 82 or 83 degrees, which could be done without very much trouble. But by the time we have reached that far we will have noticed several surprising things. We will find that whenever there is a wind from the north the weather is much warmer than when the wind is from the south. And we shall notice that ever since we passed the latitude of say 75 degrees the average temperature has not been growing any colder. Furthermore

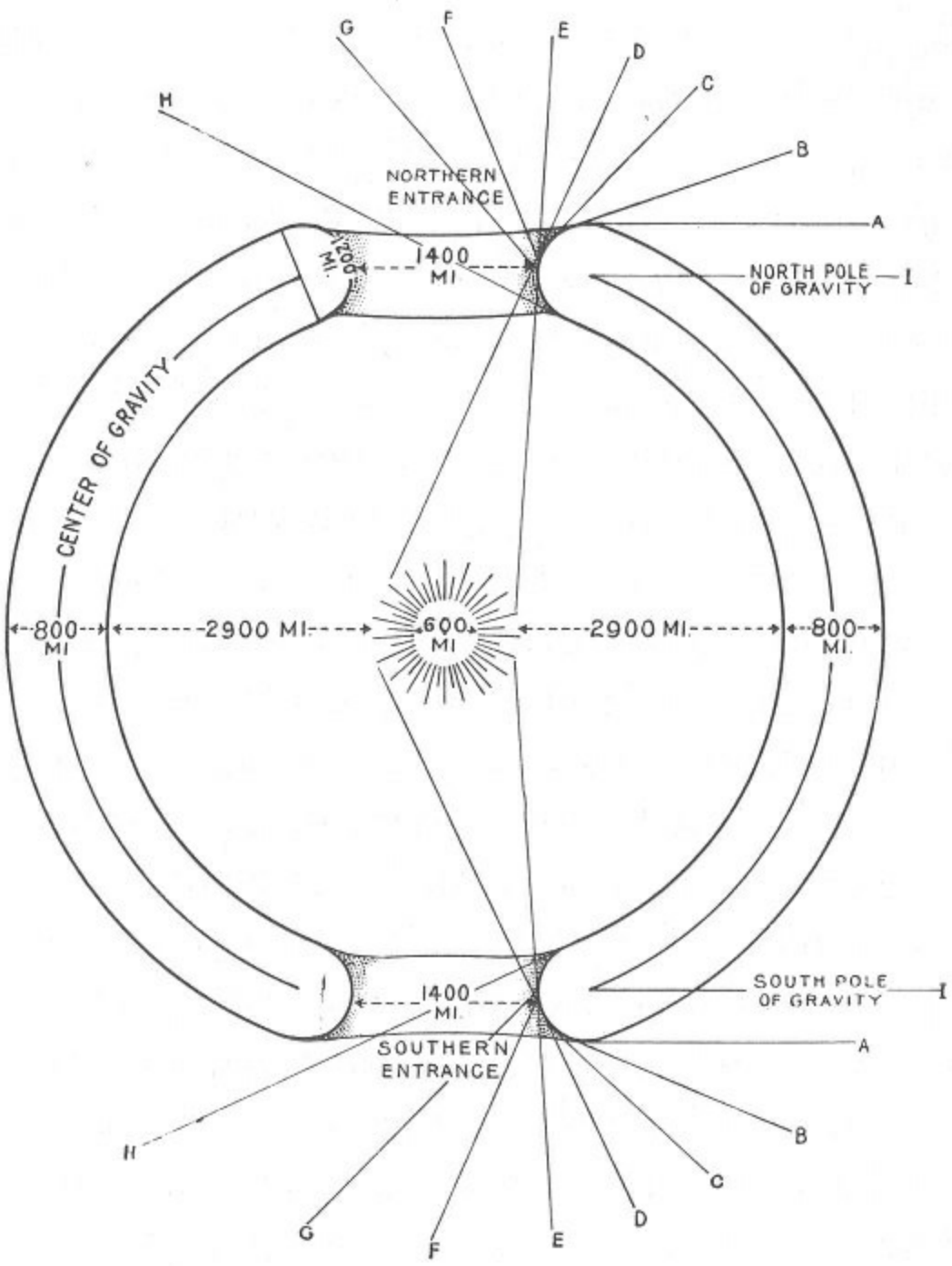


Diagram showing the earth as a hollow sphere with its polar openings and central sun. The letters at top and bottom of diagram indicate the various steps of an imaginary journey through the planet's interior. At the point marked "D" we catch our first glimpse of the corona of the central sun; at the point marked "E" we can see the central sun in its entirety. we shall notice

that there is a steady warm current of water coming from the north. From time to time we see birds in the air, and if our trip is being made at all late in the season--and knowing what we do know we shall not be afraid of some delays, for it is a hospitable country to which we are going and not a land of perpetual ice--if, we say, our trip' is being made rather late in the season we shall see many of these birds flying north. Suppose we were to leave our ship at any point along the coast of Greenland and carrying gasoline launches in sections on our sledges were to go overland until we came to the open polar sea which Dr. Hayes discovered. In that case we should have to camp every so often, and we would find plenty of game along our route and comfortable temperatures for sleeping in our tents. If it were during the summer weather, mosquitoes would be quite a nuisance. While our friends at home were picturing us as freezing with cold we would as a matter of fact be sweating with the exertions of moving camp and similar activities. Traveling in this way we could come to the coast of Grant Land or of Peary Land, and then going out on the ice-surface for a little we should come at last to the open polar sea. Then, let us suppose, we were able to set up the gasoline launches which we had brought with us in parts, loaded on the sledges, launch them, with a good supply of fuel on each, and start on the last lap of our journey.

GETTING INTO WARMER WATER

As we proceed the water rapidly becomes warmer, all trace of ice is left behind, the flocks of seabirds thicken, and perhaps we run into an immense shoal of herring going to or from their breeding grounds which are to the north of us. Our first night on the water we shall be surprised to see, after the setting of the sun, a glow in the sky which gradually defines itself as a ring covering the whole visible horizon while long streamers of light wave in fantastic patterns overhead. The Aurora, for such it is, is now no longer only to the north of us, as it would be if we saw it from a lower latitude, but it is directly over our heads and even to the south of us because we are almost on the edge of the aperture, and the reflections from the central sun come from higher strata of the atmosphere which are illuminated for an immense area by the diverging rays of the central sun coming through this immense aperture. As we proceed these auroral displays become ever more bright and steady and symmetrical. And the sun we have been accustomed to seeing in the heavens is each day a little nearer the horizon. At last there comes a time

when we cannot make any more observations by it, and one day when we wake up or rather, perhaps are awakened by the members of our crew who have been keeping watch, we find an extraordinary thing has taken place. It is apparently daylight when, perhaps, by the checking up of our time pieces it ought to be dark. Only it is a peculiar daylight. It is the sort of light which usually precedes a storm, an angry reddish light with a heavy atmosphere. If we were unprepared we would think that some terrible atmospheric disturbance was about to take place. But if we are prepared we know now that we have sailed far enough over the rim of the earth's aperture so that the sun we see is no longer the sun of the outer firmament but the inner sun which never sets. And even if our feelings did not, our instruments do tell us of a great increase in the temperature of the water and the temperature and humidity of the air. We take off some of our outer clothing. Perhaps we find that we are in one of those currents from the north which we met with before we began to sail across the edge of the aperture. If so we may find it a great deal stronger and the water a great deal warmer at this point.

As we proceed two things forcibly strike our attention: one in the "sky" as it still appears to be, and one in the water. The first is that the sun is no longer moving. It is stationary in the sky, for the small distances that we are able to traverse will only cause a very slight apparent motion of the sun, so slight that it would take a great deal more than a day's journey to make it appreciable. The other thing is that the water is fairly alive with organisms of one sort or another. Perhaps we shall see immense shoals of herring. It may be that in pursuit of them are creatures the like of which we have only seen illustrated in books on geology. When we come to very shallow water we shall certainly see species of shell fish that we have previously only seen in their fossilized condition in our museums.

LANDING IN THE INTERIOR

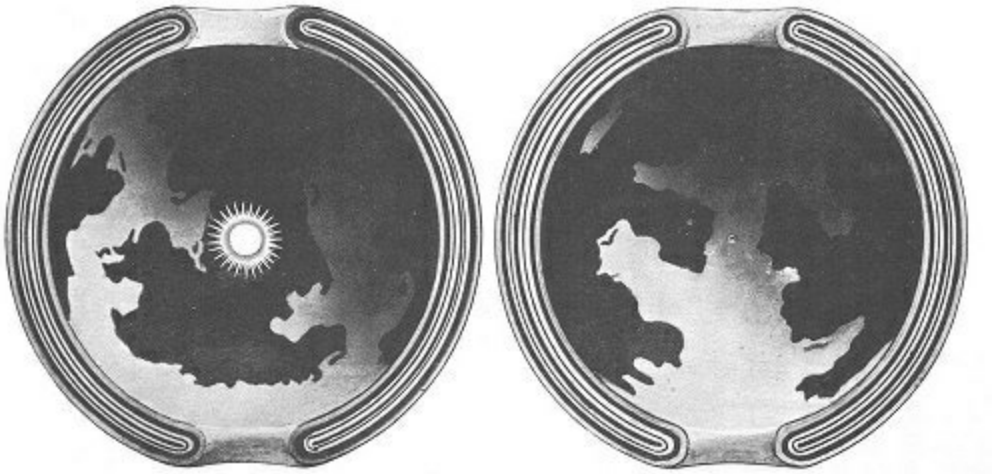
But we are approaching land and all eyes are strained to see what lies ahead. Perhaps it will turn out to be a low-lying beach, and we make for it and quickly disembark, pull up our boats, take out our tents and prepare to make our first camp. We will naturally want fresh water, and as we are now no longer in a region where it is to be obtained from ice or snow, for it is almost too hot for us here, unaccustomed as we have been by the previous

journey north to warm weather. So we look around and perhaps we are lucky enough to find that we have camped near a stream. After due rest and the necessary preparations we prepare to follow its meanderings and explore the new territory.

VEGETATION THAT IS NEW TO US

Very soon we come to vegetation. But it is of a kind that is either quite new to us or at least only reminds us of similar forms that we have seen on the outside of the earth. Immense trunks, of a sort of plant which geologists and botanists call gymnosperms, tower above the stream and stretch as far as the eye can reach on either side of its banks. They Showing the earth bisected centrally through the polar openings and at right angles to the equator, giving a clear view of the central sun and the interior continents and oceans. (Reproduced from photograph of working model.) Made by the author, 1912. Patented May 12, 1914, No. 1096102. remind us of the trees which we call conifers--such as the pine. They are covered with spinelike leaves which cling to both trunk and branches and they have no flowers. The air is warm and steamy, and dragon-flies and mosquitoes are hovering over the water of the stream and over the vegetation. Below these large conifer-like trees are species of fern, somewhat like the ferns we know but more solid and much larger, in many cases the fern clusters rising from the top of a very thick trunk, almost half the length of the larger trees, and really constituting what we would call a fern-tree and not merely a fern. Over the ground are studded great masses of Lycopods or club mosses, and green stretches of smaller mosses cover the ground. As long as the land on which we are traveling is low and near the water surface this is the predominating strain of vegetation. Later when we reach higher ground, we shall find that vegetation more like that of our own tropics has found a home. We shall see some flowers that we can recognize and we shall see some that are new to us. One very common flower will be the original starting place of that red pollen which, as we have seen, is deposited on the ice cliffs of the outer world. Judging from the quantities of that pollen we have seen on the ice cliffs of the exterior of the planet we shall not be surprised when we see that the flower itself is one which grows in immense banks or areas covering the whole ground, so that the moss or grass between the different plants is invisible. And when a strong breeze blows over these immense areas we shall see how the pollen is carried

so far for it is a very light, fine, powdery pollen, and the very air is colored as the wind blows it toward the polar opening. Our clothes are covered with it, if we happen to be in the path of the wind, and for a time it hangs in the air and is even breathed in by us as we inhale the air.



A SPONGY AND PEATY SOIL

If we dig into the soil of this low-lying land we shall find that it is a spongy and peaty soil, formed of the debris of the vegetable matter which towers above our heads. Owing to the heat and the moisture this vegetable growth is not only rank and luxuriant, but it grows four times as rapidly as the vegetable matter on the earth's outer surface. They do not stop growing as our outer plants do, because there is no setting of the sun, and they do not pause in their growth in the winter because there is no winter. This rapid growth means that they are spongy and weak in their texture. They keep expanding all the time, and so do not consolidate themselves as plants in the outer world do which grow more slowly and build their cells together more compactly. And as these plants grow quickly so do they decay quickly. Each plant soon reaches its limit, and, lying in a damp earth, its roots being spongy rather than firm, it is soon ready to topple over when a wind storm comes along. It topples and rots and soon is reduced to humus again, and in this humus of rotten leaves and branches, half buried and decaying trunks, other plants spring from the myriad seeds which are scattering around all the time. By and by the weight of these further growths on the soil pushes the old humus down and compresses it more and more, and were we to dig down a

little into this soil we should find the same thing that they burn in the cabins in Ireland--peat, that mass of vegetable matter which may be called coal in the making. If we were to dig a little lower still we would undoubtedly find natural gas, for it is a well known geological fact that a layer of peat seven inches deep will give off enough gas during its decomposition, that by the time it is ready to turn into actual coal that layer will no longer be seven but only one inch deep.

FERN-LIKE AND PARASITE PLANTS

We next notice a tree that is thirty feet or so in height but which reminds us of a very small plant we have observed on the outside and called Mare's Tail. We should hardly think of calling this tree anything so undignified for it branches out in a most amazing fashion and its main trunk is thick and sturdy looking, but we find upon close examination that the two are identical in all but size. This tree has the same jointed branches looking like a collection of immense fishing poles, and each branch is covered with a coat of flinty roughness, due to the silica with which it covers itself in minute spicules. We can pull the branches off very easily because they are jointed together in detachable bits, but we shall probably cut our hands if we do so and very painfully--just as in our childhood days we have often cut our hands on certain rough grasses.

Looking up we see parasitic fern-like plants and some with flowers like orchids drape themselves all over the larger vegetation, and these are a very active cause in its early downfall, as they quickly sap these trees not equipped to offer much resistance to such a process. Further away from the water we should find seed-bearing trees like our own of the tropics, and small plants of every description up to many of our common varieties of temperate climates, but all growing here in a ranker and more luxuriant fashion.

INSECT AND ANIMAL LIFE

We should be amazed at the abundance of insect life. On the water would be water flies of various kinds and sizes. Newt-like forms would be scrambling from water to land or sunning themselves in the pools. Occasionally under the dense undergrowth we should espy a serpent or

serpent-like creature wending its silent way. Probably we would find that these were amphibious creatures.

HOW THE MAMMOTH IS TRAPPED

A longer journey into the land would disclose to us animals which it were well to avoid meeting unless we were well armed. Certainly before long we should see herds of mammoths or at least small groups, perhaps a male and female and a young one--whom both would savagely defend if we gave any cause to suspect us as enemies. Doubtless these creatures would be met with very early in our journey, for they are fond of wandering, are not afraid, even, as we have seen, to venture to the very icebound limit of their confines; in fact their character, and probably the fact that they need certain elements in their diet given by foliage of trees that grow only near the lip, seem to cause them to wish to cover a very wide range of territory, and it is very probable that between their breeding seasons--during which time they would be further inland they venture out into the relatively colder lands of the interior near the lip. In this part of the interior there would, of course be glaciers, owing to the influence of the cold coming from the outerworld, and it is a well known fact that such continuous cold is enough to form glaciers even though the actual temperature be almost as high as the melting point of ice. One scientist tells us how, in Switzerland, he has stood on the surface of a glacier and plucked ripe cherries from off the branches of a cherry tree. We might see these mammoths walking along the surfaces of glaciers, perhaps lured on by edible pine-needles growing on the high ground. Very often they will fall into crevasses, perhaps concealed from them by snow, and the moment they fall in they will be covered by the snow and snow-water from above and hermetically sealed. That would account for the fresh condition in which they are found after these glaciers have gradually worked their way over the lip and out into the Siberian wastes where the mammoth is found in perfectly eatable condition.

ARE THERE HUMAN INHABITANTS?

Would we find any people in this strange land? While we cannot speak with certainty here it is well to remember that the Eskimo, as we have shown in another chapter, always point to this part of the earth as their ancestral

abode. And it is also note-worthy that there is a great deal of uncertainty as to the origin of the Chinese, and that it has been thought by some that the Chinese and Eskimo had a common origin. It is therefore likely that we would meet tribes here with a resemblance to both those races. That there is that common resemblance is shown by Peary's tale of the Eskimo girl he brought to New York with him, who would take no notice of the people around her but was filled with excitement when she met a Chinese in the street, and who wished at once to make friends with him. And here is another point that the reader may think speculative, but at all events it is suggestive: From where comes the up and outward position of the eye that we associate with the Chinese? May it not be a modification of the ordinary eye position induced by the fact that in the interior the sun is always in the zenith?

Certainly these tribes if we found them would find it easy living in the interior. Besides the huge plants of very early origin which we have described, the seeds of many of our own plants could have been carried to the interior by ocean currents or by birds in their crops, and we should expect to see vines and fruits of all kinds. Perhaps these tribes would have learned to cultivate them. Certainly the more interior parts of the countries we traversed would be wonderful sights from a botanical point of view. The plants which give the red pollen would, alone, probably cover areas of acres and acres in extent, judging from the amount of pollen that drifts as far away as the latitudes in which it has been seen to cover whole cliff sides and glaciers. Over these lands would roam immense herds of deer and other animals, the tribes would certainly be numerous and prosperous owing to the easy living conditions, although we might expect to find them very lazy, being so well provided for.

We should also find here the explanation of the dust which Nansen and other explorers have re-marked about in the Arctic--dust which undoubtedly had a volcanic source. Here are the volcanoes from which that dust comes, and this is the first time its presence in the Arctic has been explained.

We shall also have a physicist in the party, and he will be very much interested in the interior sun. It never rises and sets, and hence there is no night but one continuous day in the interior, and there are no changes of season. The country lies in a perpetual drowsy summer, the sunlight only being tempered by the dampness of the climate and the cold that enters from

each end and makes the interior of the earth have a climate ranging from very cold at the actual polar lips, what might be called Alpine, with glaciers, and quite tropical as we pass the Alpine section and get really into the interior.

It is very probable that our scientists will find that what keeps up the heat of the interior sun, for it is a very small one and would doubtless have cooled much more quickly than the exterior sun, is its supply of radium. In fact it is radium that is thought now to have so much to do with the upkeep of energy of our exterior sun, and so it will not be at all surprising if we find that in the interior many interesting observations are to be made relative to the part that radium plays in solar radiation of heat.

If we have a geologist with the expedition he will be very anxious to excavate as much as possible, for he has always associated iron ore with coal seams, and knows that an abundance of carbonic acid gas in the air (such as there is in the interior, for it is the gas exhaled by plants) always means that iron will be combined with it as ferrous carbonate and deposited in close connection with coal deposits. In fact we will even predict that if he does find iron ore it will be the kind called "black band ore" which is iron ore closely mixed with carbonaceous matter.

If after this trip of exploration we go back to the shore we shall find myriads of shells cast up once inhabited by various kinds of Brachyopods; clinging to the rocks will be crinoids and perhaps trilobites--creatures which we have never seen alive before, but recognize from geologists' descriptions.

Suppose that after this we penetrate our new world a little more systematically. Before we have been in it long we shall see that ranging from the plants and amphibious animals and shell fish which we have just described there are to be found here representatives of every group of animals and vegetables which we have seen since the beginning of the carboniferous epoch as occupying successive land surfaces on the outside of our globe. Always when great climatic changes took place which of course happened slowly, giving gradual warning--or when geological changes wiped out a species on the exterior--always there was this world of refuge within the globe. Here the climate was equable all through, so that excepting for any volcanic or other changes there was no destructive agency to blot out a whole species. And so here we shall find not one missing link--for which the man in

the street has always asked when he read about organic evolution--but many missing links. Certainly that animal described by the Eskimo and named by them the arcla, may well be a representative of one of the cretaceous animals with a general outline somewhat after that of the kangaroo. These animals were reptiles, however, feeders on vegetable matter and with teeth set in several rows like a tessellated pavement. As birds are well fitted to escape from both geological upheavals and climatic changes by their power of flight we should doubtless find in this refuge some of the very earliest species of birds, such as those with lizard-like beaks in which many teeth were set, birds entirely different from any existing orders on the outside of the globe. If we have an entomologist with the party he will be kept busy collecting insects. There will be the most gorgeous and large butterflies, all sorts of dragon flies, ants of several species, and in fact there will be several thousands of species of insects many of which are not known to exist on the earth today.

THE IRISH ELK AND OTHER ANIMALS

Among mammals, besides the mammoth already mentioned, we shall find Carnivores, Insectivores, Herbivores, and Primates, and many representatives of each class. Prominent among them will be an animal like our tapir or ant-eater, but his form will have more of a resemblance, anatomically, to the horse than it will to the actual tapir with which we are acquainted. We shall find animals which have affinities with the marsupials of Australia but which have the long proboscis of the elephant. Our geologist will tell us that until we saw these animals all that mankind knew about them was based on a few fossil remains which had been discovered in a rich deposit of fossils near the base of the Himalayas and later in a few places in Europe, and named Dinotherium and Sivatherium. Of the first named of those fossil animals the head alone was five feet long, but it does not follow that under the much easier conditions of life in the interior the animal has kept its formidable dimensions. In all evolution, variations are always taking place, and perhaps under the conditions in the interior of the earth a smaller animal had a better chance of life owing to greater ease in getting about. In that case the smaller animal would survive. We should find here, too, the species of animal which once lived in Europe and Ireland but died out largely because it was not adapted anatomically to its environment. This was the Great Irish Elk, and numbers of their skeletons have been taken from Irish peat-bogs. The head

and antlers of this animal were so disproportionately developed that it bent over to drink from the bog only at a considerable risk. And the fact that its remains are found in these bogs is pretty good evidence of the main cause of death among these animals after the countries in which they lived became swampy or boggy. And it is certain that the changed conditions in the interior of the earth will have had effects upon these earlier types of animals which we cannot forecast. But they will be there in their main features and an enormous number of distinct species will have survived--species so different that no inter-breeding will have taken place, and so different too that one will not have entirely killed off another, for, the extent to which one class of animals preys on another is limited.

We must also be prepared to greet early representatives of the cat and dog families. The sabre-toothed tiger goes back as far as the Quaternary epoch on the outside of the globe, and it is quite possible that we shall also meet him on the inside.

MINERAL WEaltH

It is a remarkable fact that in the mines on the surface of the earth some metals are very common and others are extremely rare, found only in such small fragments and thin veins that they are available for use as standards of value. Both gold and platinum have been used as standard of value metals because their supply is not variable. We know that there will not be much more gold in the world tomorrow than there is today. But it is quite likely that the veins of gold and platinum which are so meagre on our side of the earth's surface may be plentiful on the inner side. At all events there is rock formation there that will yield us metals as well as swampy land that will yield us coal in the making, and petroleum and gas. And we shall make all haste to explore the rocky parts of the surface--although it is very improbable that any of the rocky land will be exposed, for vegetation is so rank everywhere--and the chances are that we shall find many interesting minerals. In fact when we consider that when our outer earth was hot enough to fuse carbon into the brilliant diamond it is quite likely that at some time not far removed, the inner sun, which at that time would be enormously hot, could fuse the carbon of the interior surface in a like manner. Of course that would be when the earth was just beginning to cool, when probably its whole outer

envelope was still hot enough to be plastic--for diamonds are only crystallized at a tremendously high temperature and pressure but it is a safe speculation at any rate. And while that discovery would be of sensational interest because diamonds are so sought after, other discoveries of even greater scientific interest would be made.

EMERGING AT THE OTHER POLAR OPENING

Finally, if our expedition were well enough equipped with ships we could sail through the oceans of this interior world, explore its coasts, sail up its rivers, and finally, come out on the outer side. Here, however, we would need every aid that the Antarctic explorer has to have, for the journey from the Antarctic polar lip to the nearest civilization would be a far more arduous one than is the similar journey in the north. But if we had taken our aeroplanes through the interior with us, success would doubtless crown our flight and we should return to civilization having explored the last part of the earth that is left to explore and having added nearly as much again to the area and resources of the lands on which life may flourish and from which may be dug or taken by cultivation. We should be hailed as the greatest explorers in the history of the world. We should be honored by republics and by kings; by scientists and by magnates of commercial enterprise.

And so we leave this part of our subject, hoping that we have fired the ambition of the reader to see within a very short time this work of exploration undertaken. Our country has the men, the aeroplanes, the enterprise, and the capital. Let our country go ahead with this great work. Or if our country hangs back let private citizens earn the glory that will be theirs if they assume the glorious task of opening up this new and teeming realm. It is the greatest privilege that has ever been offered to an explorer, and we are very sure that there will be many explorers eager to grasp it and certain to succeed when they have grasped it.

CHAPTER XVIII. THE FORMATION OF THE EARTH

We shall now proceed to explain the shape and the formation of the earth which has resulted from the evolution of our planet from the nebula, a shape which we are quite ready to understand after our study of Mars and the other planets. For convenience of description we have assumed certain measurements to be true. Of course we do not pretend that we have actually made these measurements, for no one is yet in a position to make them. But basing them upon the relative proportions of the polar cap of Mars and upon other considerations, we put them forward as the most likely approximations. The polar openings then, we should put at not less than 1400 miles across in each case. And it is probable that the crust of the earth is 800 miles thick. This means that when a ship sails over the lip of the polar orifice it is sailing over what may be compared to the circumference of a circle whose diameter is 800 miles. That means that the curvature would be just as imperceptible as the ordinary curvature of the surface of the earth--which indicates how absurd are some of the notions which our critics have of the nature of the aperture. The interior sun may be supposed to be 600 miles in diameter, so that the distance between it and any point on the inner surface which it warms is 2900 miles, and these figures added give us 8,000 miles which, as we know, is the diameter of the earth.

HOW PEOPLE DISAGREE ON THIS SUBJECT

Now if we asserted that this was the shape of the earth and had no evidence drawn from other planets or from polar exploration, we should be laughed at but the laughter would come from two sets of people each one of which may also laugh at the other set. So, if they disagree among themselves it looks all the more likely that neither may be right.

These people are the old fogies who believe that the earth is a solid shell enclosing a vast seething mass of molten matter which occasionally breaks out of the shell in the form of volcanoes, and the newer thinkers who claim that the earth is the most rigid of solids it is possible to conceive. 'We shall

now proceed to show how both of these theories fail.

THE OLD LIQUID INTERIOR IDEA

Of the old liquid-interior people it is not necessary to say very much. Their day is over. Scientists no longer put any credence in that notion--it is only in school books that it survives. If the earth had been a thin shell over a liquid interior it never would have survived in the form which these people allege. For just as the moon attracts the tides of the water on the surface, so it would have attracted the liquid interior which would have pushed through the crust at whatever point the moon happened to be, as fast as that crust was formed.

WHAT CAUSES VOLCANOES?

What, then, says the reader, causes volcanoes and earthquakes? Let us ask the scientists. In Edwin S. Grew's, "The Romance of Modern Geology," we are told that the earth is continually indulging in small shivers--a thing which can much more easily be explained on out theory than if we suppose it to be a rigid solid. These are probably due to the fact that the crust is seamed with great cracks, and occassionally there is a sort of cave-in which will send a tremor throughout the whole shell. When these cracks are on a very large scale we get a chain of volcanoes as is the case in South America. Here is what Grew says about it:

"The volcanoes of the great chains of the Andes lie along a straight crack reaching from Southern Peru to Terra del Fuego, 2500 miles in length. The volcanoes of the Aleutian islands lie along a curved track equally long. Other shorter lines of volcanoes are very numerous, and since countless others existed in former times the cracks in the earth's crust must be exceedingly numerous. There is one crack which comes to the surface in various places in Eastern Asia and Western Africa, and stretching from the Dead Sea to Lake Nyassa, reaches the enormous length of 3500 miles."

WHAT WOULD HAPPEN IF INTERIOR WERE LIQUID?

Now it is obvious that with such surface flaws as that, a molten interior

would break through upon any such attraction as that of the moon, and if the break once started it would extend all along those vast territories just mentioned.

SURFACE MANIFESTATIONS

That both earthquakes and volcanoes are phenomena of the surface of the earth only and do not go deep, is further shown by Mr. Grew in the volume from which we have already quoted. Many of them he lays to the existence of what are called, in England, "pot-holes," which are deep and ramifying caverns in the earth which may extend to a depth of nearly a thousand feet, disclosing to the explorer vast chambers hundreds of feet high, connected by smaller passages. Obviously where the earth is thus honeycombed a subterranean landslide may take place at any time, due, perhaps, to water erosion in the caverns, and the result would be a local earthquake.

It is also interesting to note that, if the earth were a thin crust covering a center of molten lava, in any earthquake or volcano in which that lava came to the surface, the solid rocks of the surface being heavier than the molten material, would sink until they came to rest at the center, and this process would soon eat up the whole surface of the earth, and that process would have begun to take place as soon as the earth began to cool. For as soon as any part of the crust solidified it would sink. It is impossible to suppose that the whole exterior of the earth solidified at one moment and so imprisoned forever the molten material underneath. But merely to state this theory is to show how ridiculous it is. As one critic puts it:

"These savants have managed somehow to keep those raging fires burning from the very earliest periods of even the sun's history, without any abatement or cessation, and they tell us it is now raging with inconceivable fury in the bowels of our own earth and within all the planets, and, in accordance with their ideas, it seems likely to continue burning on forever. They conclude by computation that this fire occupies more than thirty-five out of thirty-six parts of this globe, and in some inexplicable manner, they have been enabled to keep this positive element in active operation, without furnishing one particle of combustible material to replenish its exhausted resources. This, we must admit, is the most astounding feat that philosophy has ever performed in the whole range of celestial and terrestrial mechanics,

if it has been successfully accomplished."

And here is a point which renders the igneous theory of the earth's interior quite unnecessary to account for volcanoes:

"Professor Denton remarks that . . . coal may exist in layers or stratifications alternately with shales and underclays for 'more than eight miles,' or even a greater distance. Now, if we look about us we think we may find a sufficiency of explosive and combustible materials, to produce all those volcanic and thermal phenomena, without resorting to a vast interior fire globe for the original cause."

That volcanoes are purely surface manifestations is shown by the fact that on many occasions it has been proved that the cause of a volcanic eruption was the access of sea water through one or more fissures to the hot base of the mountain. The proof of this is the presence of compounds formed by the salt of the sea water in the lava which was ejected.

But nowadays the scientists themselves admit that this igneous theory is an impossible one. Grew, in his "The Romance of Modern Geology," in fact, gives the whole case away when he says:

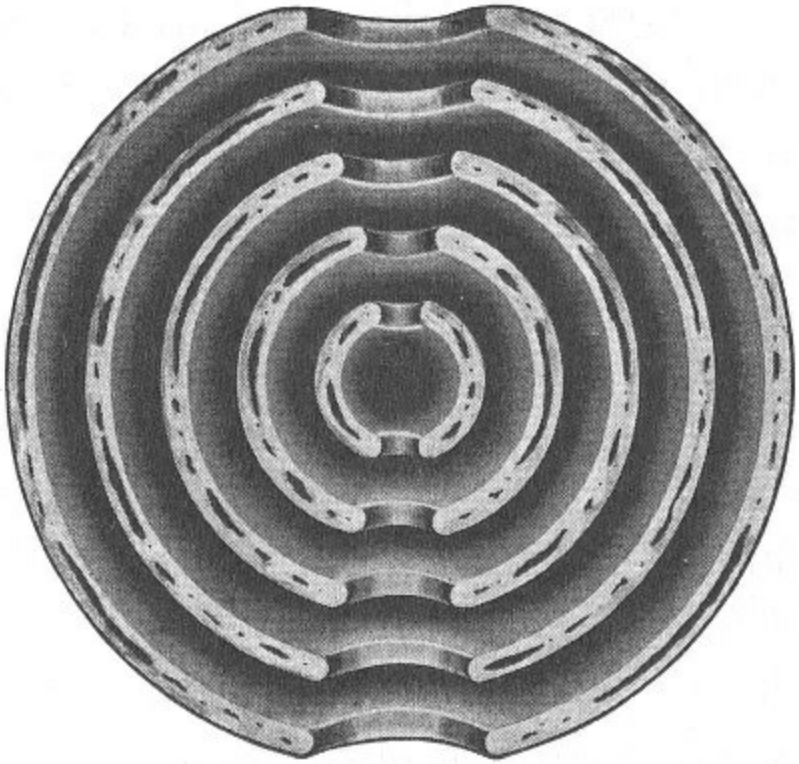
"The earth is not so solid as it looks and not so solid as it feels."

AN IMPOSSIBLE OCEAN

And furthermore he supports us in what we have said of the impossibility of a molten interior being held in by a crust:

"For that would leave a molten ocean more than 7900 miles across any way in which it was measured: 7900 miles deep, 7900 miles broad, 7900 miles long if we take 8000 miles to be the diameter of the earth. We all know what great tides the sun and moon by As so many people have thought our theory was in some way like that of Symmes we present herewith a diagram of the sort of earth that Symmes supposed to be under our feet. A study of this diagram will show at once the absurdity of thinking our theory is in any way like Symmes'. Each of the five shells represented above is, according to Symmes, revolving on its own axis at a rate differing from the rate at which any other shell is revolving. In the interior of each individual shell there are

great hollow spaces or cavities and in each of these large spaces there is life, as well as there being life on the surface of each of the shells. Besides these immense spaces in each shell there are smaller spaces or gas pockets. And it should be noticed that on Symmes' theory there is no central sun. And as there is no central sun there can be no light in the interior except the very little that reaches the outer surface of the spheres by filtering through the openings from the outer sun. Not only would that he a very inadequate amount of light and heat--not enough to maintain life, but there is absolutely no provision at all for lighting the inner spaces or cavity of the spheres--although Symmes claims they are inhabited. We simply ask the reader to imagine such a collection of whirling spheres, each with its great hollows which can neither he entered or left, and yet each supporting life, and put to himself the question how such a conglomeration as that could ever be evolved from a nebula. And yet some people read about our theory and then state that our theory is related to Symmes' ideas. How absurd. their attractions raise in the earth's outer ocean of water. Think what tides they would raise in this inner ocean of molten rock and metal. The earth's crust would not be able to hold such tides in. The molten stuff would always be breaking through the flimsy thirty miles of outer solid rock as if it were egg-shell. Twice a day there would be outbreaks of lava vast enough to submerge continents."



He then quotes Lord Kelvin to the effect that the heat of the earth's crust does not continue the further down we go, as had always been supposed, but that that increase only holds for a short distance, and then ceases. And then what?

EARTH DOES NOT WEIGH ENOUGH TO BE SOLID

Grew does not know, and the scientists don't know, but Grew does make this very significant confession:

"We know that the earth cannot be solid all through because it does not weigh enough." He then gives a number of conflicting theories as to what is to be found in the further interior--whether solids, liquids or gases. The fact that scientists conflict at this point shows that they have not sufficient data to build a consistent theory that will not conflict with the facts. And they never will be able to reconcile their conflicting views until they accept all the evidence--and that has been given for the first time in the present book.

OBSERVATIONS CONTRADICT SCIENTIFIC THEORIES

Now as a matter of fact the actual observations made by scientists contradict both the usual scientific theories. We have spoken of the idea that the earth is molten in its interior. When we say that one writer in the *Scientific American Supplement* for January, 1909, lays it down as proven that the crust of the earth is so thin that it can only be called a "scum" formed by the oxidizing of the metals and other elements of the earth--just as a scum of oxide is formed when air comes in contact with the surface of molten lead. When this scientist claims, furthermore, that this scum is only twenty miles in depth, the reader will readily see how ridiculous the idea is on the face of it. As we have said, the attraction of the moon for the molten tides underneath would burst that scum as fast as it could form. It was the recognition of such absurdity that threw scientific opinion over to the other extreme--to-wit, that the earth was a very rigid solid.

WAS THE EARTH EVER MOLTEN?

Of course there are varieties of this theory. One variety is that which says that the earth was once molten but is now entirely solid. But some scientists hold another variety of the theory: that the earth never was molten. Dr. Arthur Holmes who has analyzed rocks and meteors for their radium content thinks that the earth as a whole never was molten but that when it was a nebulous gas it attracted and caught what he calls "planetesimals"--which were solid, and so built itself up. Probably, dear reader, you did not know that scientists disagreed among themselves to that extent, did you?

In fact scientists have been so puzzled because their observations of the behavior of the earth's crust under various strains and attractions, did not agree with their theories that, some years ago, the celebrated Professor Geikie, one of the world's greatest geologists, was forced to admit that the problems arising from consideration of the evolution of the surface of the earth were still in a state where no solution was visible. And to escape the difficulties propounded by Professor Geikie, Professors Le Conte and Shaller suggested that the earth was neither a solid spheroid nor a shell with a liquid interior but that it consisted of an outer, solid crust, then, inside of that, a liquid or viscous stratum, and then a solid core inside of that again. 'What strange theories the scientists are reduced to when they ignore the facts!

DR. HERZ ON EARTH'S SOLIDITY

As for the theory that the earth is a solid, rigid body with its rigidity equal to that of steel,. here is what Dr. N. Hertz has to say about the idea:

"All the calculations which give the earth a rigidity as high as that of steel are based upon the erroneous assumption that the great pressure existing in the interior of the earth (the pressure at the earth's center is estimated to be about three and one-fourth million atmospheres) is a true measure of the rigidity of the earth. This is as incorrect as an assumption that the pressure of 800 atmospheres which exists at the sea bottom, five miles below the surface, is a true measure of the rigidity of the water at that point. In either case the pressure is the hydrostatic pressure due to the weight of the mass above, and the comparatively very thin solid crust of the earth is as susceptible to deformation by centrifugal forces as a shell of solid elastic material, sixteen inches in diameter and 1-30th of an inch thick would be."

Here we see is more contradiction. We agree with Dr. Herz that it is absurd to speak of the enormous pressure down at the center of the earth. But the earth is certainly not to be compared to his globe full of water--that we have already shown.

While, then, these scientific theories all conflict, what scientifically observed facts are there that will help us to the true solution?

LET US LEAVE THE THEORIES FOR FACTS

Let us ask those scientists who have been observing instead of theorizing.

First we will call to the witness stand Professor A. E. H. Love who wrote for the Science Progress, Volume of 1912, a review of the third edition of Sir G. H. Darwin's book, "The Tides and Kindred Phenomena of the Solar System." He notes that Sir G. H. Darwin is the world's greatest authority on this subject and he also notes that in this third edition of his celebrated book one-quarter is either added or rewritten--showing that what seemed true only a few years ago has been superseded by new ideas. This ought to warn us against the dogmatism of clinging to the older ideas about the earth's constitution. For this book in the reader's hands is simply a step in advance of

the orthodox scientists of today, and tomorrow they may change their ideas and accept ours.

G. H. DARWIN'S OBSERVATIONS

Now, as a result of his observations, Sir G. H. Darwin comes to the conclusion that:

"The body of the earth, on which the oceans rest, cannot be absolutely rigid. No body is. It must be deformed more or less by the attractions of the Sun and Moon." So he will try, he says, to find out just how those changes can be observed. His first attempt was to find out the "actual height of the so-called fortnightly tide." By fortnightly tide is meant "a minute inequality in the tide-height, having a period of about a fortnight, depending upon the inclination of the moon's orbit to the plane of the equator. . . Now the amount which the fortnightly oceanic tide would have if the Earth were absolutely rigid can be calculated." But the results show that the earth is not absolutely rigid and they also show that it is not as far from rigid as it would be if it were a shell surrounding a liquid center. In other words the shape of the earth does yield to some extent under the force of the moon's attraction, and the yielding is not small enough to justify us in saying that the earth is practically rigid and it is not large enough to suggest that the earth is a viscous mass. The reviewer goes on to say:

"It is true that Lord Kelvin proved long ago that, if the earth were homogeneous and incompressible, it would have to be as rigid as steel to make the observable height of the fortnightly tide as much as that calculated from other data, before the actual observation was made." But, the reviewer goes on to say, other experiments show that the earth is not a rigid solid, among them being the experiments with a pendulum conducted by Prof. O. Hecker in Potsdam who showed that the actual movements of a pendulum, compared over a long time, are not as great as they would be if the earth were a solid body.

Now if the earth is not a solid, rigid body on the one hand or a shell-encrusted viscous or fluid body on the other hand and as we have seen scientists can prove neither the one thing nor the other--there is left only one possibility--that the earth is hollow, and that is the possibility which every

page in this books shows to be the actuality.

And here are further scientific observations that make this more certain still, from the actual observation of the earth itself. (For, of course, it is absolutely certain from the other standpoints already discussed.) The most interesting of these observations are along the line of earth tremors. Some of these observations were made as early as 1882 when a writer in the *London Times* described how he felt the earth shake when a party of friends were ascending a hill on whose crest he was lying at full length. This observation, he said, made him quite ready to understand the statements made by George H. Darwin--quoted above in another connection--and Horace Darwin, at a meeting of the British Association for the Advancement of Science--when they described how the earth was in a constant state of tremor. Experiments carried on by the two brothers showed that the earth was in a constant condition of vibration, not discernible to us, of course, but clearly shown by the pendulum and other delicate apparatus by which the tremors were magnified and recorded. The writer goes on to say:

EARTH TREMBLES LIKE A SOAP BUBBLE

"When regular series of observations are made it is found that the pendulum is hardly ever steady. . . . Some days it may be more quiet than others and generally there is evidence of distinct diurnal periods, but the minor zig-zags constantly interrupt and sometimes reverse for an hour together the slower march northward or southward."

Now it is evident that a solid globe of great rigidity would not behave in this way, but if the reader remembers how a curved sounding board to a violin or other musical instrument vibrates he can easily see how the lunar, solar and other attractions bearing upon the earth and constantly changing--the earth tides in short--would cause just such tremors.

J. Milne, writing in *Nature* in 1894 also speaks of these and larger vibrations. He says:

EARTHQUAKES SCIENTIFICALLY UNIMPORTANT

"Earthquake observations, although still capable of yielding much that is

new, are for the present relegated to a subordinate position, while the study of the tide-like movements of the surface of our earth, which have been observed in Japan and Germany, earth tremors and a variety of other movements, which we are assured are continually happening beneath our feet, are to take their place. Only in a few countries do earthquakes occur with sufficient frequency to make them worthy of serious attention. . . . The new movements to which we are introduced are occurring at all times and in all countries. . . . Great cities like London and New York are often rocked to and fro; but these world-wide movements which may be utilized in connection with the determination of physical constants relating to the rigidity of our planet's crust, because they are so gentle, have escaped attention.

CRUST IN CONSTANT VIBRATION

"That the earth is breathing, that the tall buildings upon its surface are continually being moved to and fro, like the masts of ships upon an ocean, are, at present, facts which have received but little recognition. . . . It seems desirable that more should be done to advance our knowledge of the exact nature of all earth movements, by establishing seismological observations, or at least preventing those in existence from sinking into decay."

But the usual scientific theories to account for these tremors are very confused and contradictory. Thus Abbe T. H. Moreux, writing in *Cosmos*, 1907, says that the tremors which precede earthquakes travel through the earth so quickly that they must be generated under conditions which are not found in any solid. He then goes on to try to prove that the earth's interior is fluid but under exceedingly high pressure. He argues strenuously for this view, but as we have seen, it is an outworn view.

CONFESSION OF SCIENTIFIC BANKRUPTCY

For instance, writing even before the scientist quoted above, a reviewer of scientific progress says:

"Gradually the very existence of the molten nucleus of our planet became more and more problematical. Already the mathematical investigations of Fourier and Poisson had shown that, owing to our very imperfect knowledge

of the physical aspects of the question, we are reduced to mere conjectures as regards the state of the inner parts of our globe. Later on the admirable investigations of Sir 'William Thomson, G. H. Darwin, Mellard Reade, Osmond Fisher, R. S. Woodward, and others rendered the existence of a molten nucleus surrounded by a thin, solid crust, less and less probable. And the geologist had to conclude that, as long as physics would not supply more reliable data for a mathematical investigation, he had better leave the question as to the physical state of the inner parts of the earth unsolved, and study the dynamic processes which are going on in the superficial layers of the planet."

Now if that is not a confession of the bankruptcy of orthodox science in this realm we do not know what would be so considered. The problem is frankly and totally given up. Does not that justify a man, who is not a scientist but who has observed the facts, to enter the field and propound a theory, especially when the theory shows just why the problem has to be given up by the scientists: because it concerns something which does not exist--the constitution of the material of the earth below the "superficial layers." That part of the earth is neither solid nor liquid because it is filled for the most part with the earth's atmosphere covering an earth surface very like our own.

EARTH IS NOT HOTTER AS ONE PENETRATES TOWARD CENTER

Let us refer to one more point. Every reader is acquainted with the fact, as reported by miners and other observers, that the further one digs into the earth the hotter it gets. It was that idea that led people to believe that if they dug far enough they would come to a depth where it was so hot that everything would be in a molten condition. But that idea, too, must go, as being no longer in accordance with the evidence. Prof. Mohr of Bonn has written a very important paper on thermometric investigations of a 4,000 feet boring at Speremberg who finds that while there is an increase of temperature,, as we go down, the rate of that increase gets less and less all the time, so that soon it will be nil; that is to say there will no longer be any increase, and the point at which the heat would cease to increase would be about 13,550 feet.

Well, we could quote other scientists who disagree one with the other but it would simply be a repetition of what we have already said. So let us simply take their confessions of ignorance and ask them to investigate our claim to have dispelled that ignorance by a theory which cuts clear from all their contradictory ideas and goes to the root of the matter and is capable of the direct proof of observation.

CHAPTER XIX. HOW OUR THEORY DIFFERS FROM THAT OF SYMMES

Some very unintelligent readers have accused us of putting forward a theory that is not new but merely a rehash of Symmes theory of Concentric Spheres. To show how utterly foolish and misguiding this idea is, we shall give a short account of Symmes' Theory from the one authoritative text book in which it has been recorded, and we shall then briefly recapitulate the main features of our own theory. And the reader will see that they are so far apart that there is no excuse whatever for confusing the two.

UNLIKE IN METHOD AND IN RESULT

The very first article of Symmes' shows how widely different it is from ours, and shows also how it is even worked out by another method of thinking than ours. We take the facts first and ask what they teach us. Symmes deduces his theory from what he thinks is a universal principle, and then gives us a few facts to back it up. But here is the first article in the Symmes creed:

HIS CONCENTRIC SPHERES

"According to Symmes' theory the earth, as well as all the celestial orbicular bodies existing in the universe, visible and invisible, which partake in any degree of a planetary nature, from the greatest to the smallest, from the sun down to the most minute blazing meteor or falling star, are all constituted, in a greater or less degree, of a collection of spheres, more or less solid, concentric with each other, and more or less open at their poles; each sphere being separated from its adjoining compeers by space replete with aerial fluids; that every portion of infinite space, except what is occupied with spheres, is filled with an aerial elastic fluid, more subtle than common atmospheric air; and constituted of innumerable small concentric spheres, too minute to be visible to the organ of sight assisted by the most perfect microscope, and so elastic that they continually press on each other, and change their relative positions as often as the position of any piece of matter

in space may change its situation: thus causing a universal pressure, which is weakened by the intervention of other bodies. . ."

HIS OWN IDEA ABOUT GRAVITY

Well, we need not quote any further from that because Symmes here goes off into a theory of his own regarding the law of gravity; but we should like to point out that what he says above is very different from anything we have ever said. Let the reader notice that although his concentric spheres are "more or less solid" still they have open polar orifices, which are however, only "more or less open" again. Thus Symmes is very indefinite about the real constitution of his planets. And the reader will also notice that he includes the sun of our own solar system and all other suns as being built in the same way. But how could a sun whose structure is the same as the planets, and which must, therefore, be like the planets in age as well as in other characteristics how could such a sun have enough heat to warm all the planets? We know by actual observation of our own sun that the heat on its surface is so great as to vaporize the solid elements and even make the gaseous elements incandescent. In such a sun all concentric spheres would be melted down. Such a constitution is impossible. And yet people compare Symmes's theory to our own theory and say they are the same.

FIVE HOLLOW SPHERES FORM HIS EARTH

The exposition of Symmes' theory from which we are quoting goes on to describe his idea of the form of the earth:

"According to him, the planet which has been designated the Earth is composed of at least five hollow concentric spheres, with spaces between each, an atmosphere surrounding each; and habitable as well upon the concave as the convex surface. The north polar opening of the sphere we inhabit is believed to be about four thousand miles in diameter, and the southern about six thousand. The planes of these polar openings are inclined to the plane of the ecliptic at an angle of about twenty degrees; so that the real axis of the earth, being perpendicular to the plane of the equator, will form an angle of twelve degrees with a line passing through the sphere at right angles with the plane of the polar openings; consequently the verge of the polar

openings must approach several degrees nearer to the equator on one side than on the other. The highest north point, or where the distance is greatest from the equator to the verge of the opening in the northern hemisphere, will be found either in the northern sea, near the coast of Lapland, on a meridian passing through Spitzbergen, in about latitude eighty-six degrees, or somewhat more easterly in Lapland; and the verge would become apparent, to the navigator proceeding north, in about latitude 90 degrees."

HIS POLAR OPENINGS altOGETHER DIFFERENT

Now see how differently Symmes goes about his task. He simply assumes this, that and the other to be the case. He assumes that the southern polar opening is two thousand miles greater in diameter than the northern one. Why? We do not know. He assumes certain inclinations of the planes of the polar openings to the plane of the ecliptic. He tells us where the highest northern point will be found--only as he is really not sure he gives two possible locations. We decline to give any data in advance of actual exploration. If we say that the openings into the interior of the earth are at such and such a point we are simply making an approximation based upon the actual evidence of navigators. We have done much exploring since Symmes wrote, but even with the newer discoveries in mind it is not safe to indulge in a lot of very definite figures and anticipations. We prefer to stick to the actual facts as navigators have found them.

HIS DOUBLE SHELLED SPHERES INHABITED INSIDE AND OUT

Now here is another point in which Symmes' theory differs radically from our own:

"Each of the spheres composing the earth, as well as those constituting the other planets throughout the universe, is believed to be habitable both on the inner and outer surface; and lighted and warmed according to those general laws which communicate light and heat to every part of the universe. The light may not, indeed, be so bright, nor the heat so intense, as is indicated in high northern latitudes (about where the verge is supposed to commence) by the paleness of the sun and the darkness of the sky; facts which various

navigators who have visited those regions confirm; yet they are, no doubt, sufficiently lighted and warmed to promote the propagation and support of animal and vegetable life.

"The different spheres constituting our planet, and the other orbs in creation, most probably do not revolve on axes, parallel to each other, nor perform their revolutions in the same period of time, as is indicated by the spots on the belts of Jupiter, which move faster on one belt than another."

It was because he had noticed the belts of Jupiter that Symmes was led in the first place to suppose that the planets might be composed of concentric shells, and he explains these belts or tries to--by talking of the reflection of light from the different verges of the shells which compose Jupiter. By why does he suppose that the earth should have at least five of these shells?

THEORY CANNOT BE TAKEN SERIOUSLY

It will be noticed that Symmes has no coherent theory, or at least no observed facts which will clearly show how the spaces between the verges are lighted and warmed. This is perhaps the point where the theory breaks down most disastrously. We have shown that there is more heat in the interior of the earth than there is outside of that realm, not less. And we have shown it from observed facts--Symmes depends on theory, and he is wrong.

Symmes also claims that:

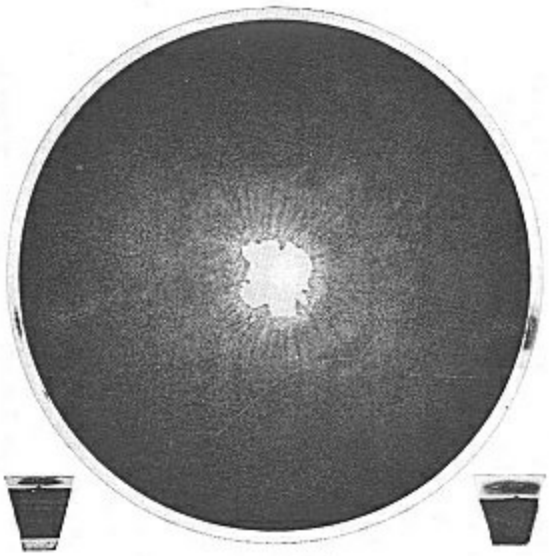
"The atmosphere surrounding the sphere is probably more dense on the interior surface than on the exterior, the increased pressure of which must increase the force of gravity; as the power of gravity must increase in proportion as we approach nearer the pole. Clouds formed in the atmosphere of the convexity of the sphere, probably float in through the polar openings, and visit the interior in the form of rain and snow. . ."

This, it will be seen, is the very opposite of our theory. There is no snow in the interior of the earth, except near the polar openings.

Symmes' theory differs from ours too, in that Symmes thinks there are in each sphere cavities in the center of the matter composing it, and that these cavities are filled with a very rarefied gas or elastic substance, something, he

says, like hydrogen. These mid-plane spaces, as he calls them, tends, he claims, to give the sphere "a degree of lightness and buoyancy." He also thinks that other interstices exist nearer the surface of each sphere and of quite limited extent. The gas, his chronicler states, "escaping from these spaces is, no doubt, the cause of earthquakes; and supplies the numerous volcanoes. This gas, be-coming rarefied and escaping, must occasion most of these great revolutions and phenomena in nature, which we know to have occurred in the geology of the earth. This ærial fluid with which the mid-plane spaces or cavities are filled, may possibly be adapted to the support of animal life; and the interior surfaces of the spheres formed by them may abound with animals, with organs only adapted to the medium in which they are destined to inhabit."

Now it is obvious that this is not to be taken seriously. To compare such thought as that to our theory is patently absurd. Instead of studying the A sectional view of the earth's shell, showing that volcanoes originate in small lakes of molten material located near the surface.



A sectional view of the earth's shell, showing that volcanoes originate in small lakes of molten material located near the surface.

A sectional view of the earth's interior, showing a volcano being fed from the great internal ocean of liquid lava according to the old but very illogical theory.

A sectional view of the earth's interior, showing a volcano being fed from the great internal ocean of liquid lava according to the old but very illogical theory.

This view shows the earth's interior as an ocean of molten lava approximately 7,800 miles in diameter, enclosed within a rigid crust 100 miles thick and surrounded by an atmosphere 200 miles in depth, according

to the hitherto generally accepted but very illogical theory. facts as we have done, Symmes simply makes up a new idea to explain away each fact as it hit him in the face. He had to account in some way for volcanoes, so he made each of his spheres not only a hollow ball with another sphere inside it, but he gave it a double shell with mid-plane spaces or cavity between the two shells and other interstices in which there was a gaseous and elastic fluid. Why that fluid should sometimes burst forth as volcanoes or earthquakes he does not say. There does not seem any reason why, once imprisoned, it should not stay there forever. If it were going to burst forth at all it ought to have done so while the spheres were relatively hot, before they had cooled down to the rigidity which as a matter of fact overtakes all planets when they solidify. And then why does he go ahead and postulate the existence of animals in his mid-plane spaces? As these are not, like the spheres themselves, open at any place, there would have to be a separate creation of the animals in each one. How uncalled for is any such fantastic notion as that!

Symmes also argues for the hollowness of his concentric spheres by asserting that hollowness is a principle of nature that the stalk of wheat is hollow, that the bones of animals and birds are hollow and the hairs of our head are hollow.

But in each of those cases the hollowness is there for a purpose. In the case of the bones it is there as a chamber to hold the marrow. The birds have very light bones, with large hollows, because the species with the lightest bones have been able to fly better and so have survived in the struggle for existence. If we were to assert that the earth must be solid because all pebbles on the beach are solid, because the trunks of trees are solid and the tusks of elephants solid we would be using the same sort of argument that Symmes is using--arguing from apparent analogies--and we would be quite wrong, because, as a matter of fact, and as we have shown in this book the earth is not solid.

But we prove that it is not solid by facts. Symmes tries to prove his assertions by remarks such as the above.

Of course it is true that everything in the universe tends to assume the cellular form. That we admit and have commented on. But there is always a reason for the particular kind of shape and composition of the cell, whether it

be a vegetable cell in a leaf, a cell of the protoplasm of an animal, or the huge cell, open at both ends, with a nucleus or a central sun, which forms the earth. And in every case the reasons for those formations must be found in the study of the body itself, and not in making far fetched comparisons between that and other bodies far removed from it in character and purpose and composition.

WOULD EXPLAIN POLAR CAPS AND PLANETARY RINGS BY REFRACTION

Symmes also tries to explain the appearance of the other planets besides Jupiter as being due to refractions of light as the different verges of the spheres were turned toward us, but he does not by this method succeed in clearly stating just how such appearances could account for what we observe. He says, for instance, that the belts of Jupiter: "would be produced by the shadow cast on the space between the polar opening of one sphere and the adjoining one; that is, a portion of the sunshine would be reflected from the verges of the spheres on which it fell; and another portion would appear to be swallowed by the intervening space. And if refraction bends the rays of vision between and under his spheres as it bends a portion of the rays of the sun, so as to produce the apparent belts of comparative shade, then a very complete solution of those appearances, heretofore considered wonderful, would be afforded. The variation which has been observed in their number, shape, and dimensions, can in no better way be accounted for, than by concluding the planet is constituted of a number of concentric spheres, of different breadths, revolving on different axes and with different velocities, so as sometimes to present to our view the verge of one sphere, and sometimes that of another; and the rays of the sun falling on the parts of the verges present to us, would occasion the diversified appearances which we discover."

Well, he goes on a little further along that line but we need not follow him, for it is obvious that his explanation does not work.

Take Mars, for example. If our theory were wrong and Symmes were right, the polar caps of Mars would be made invisible every so often because some inner sphere, revolving at its own rate on its own axis, would cover up

the polar opening on the outer surface. But the polar caps of Mars are always bright, with certain variations, and what is more, we see direct gleams of light from the Martian interior sun penetrate through the aperture and strike directly into our telescopes. This could not possibly happen on Symmes' theory, for there would be no interior sun from which light could come.

And yet people say that our theory is the same as Symmes' theory.

SYMMES ON SUN SPOTS

Symmes also tries to explain the spots on the sun by his theory. He thinks they are vast holes or fractures in the outer surface or crust through which the inner crust appears. But as we have already stated the sun is not made on that plan and could not be. That Symmes took no account of the great heat of the sun shows that he elaborated his theory largely out of his own mind. He did not get the facts first and trim his theory to fit the facts. He first thought out the theory and then only took cognizance of those few facts which fitted it. Other facts he ignored. This is just the opposite of what we have done. We have taken every fact into account as the list of authorities which we have consulted abundantly shows.

Now let the reader contrast that whole theory with our array of facts. Just because matter tends to take the spherical shape, when no outside forces interfere with it, and because he has seen appearances when observing Jupiter that suggest that the rings round that planet may be optical delusions, not rings at all, but outer shells, Symmes builds up the theory that all planets and suns are composed of concentric spheres. Why these spheres revolve on different axes and at different speeds he does not tell us, and on all those points of his theory that are most doubtful and need the most cogent arguments to prove them, he is most vague.

SYNOPSIS OF OUR OWN THEORY AS CONTRASTED WITH SYMMES

How different is the theory outlined in this book. When we say that the earth is a hollow body with polar openings and an interior sun, we back up the statement by referring to nebulas in many stages of evolution in which the

gradual forming of the outer envelope of the future planet and the interior sun, and even the beginnings of the polar openings, are all clearly visible in their different stages. Then we point to the actual constitution of the planets, Mars, Venus, and Mercury, and we show just what the polar openings are like. We show that they are not ice caps, because direct light has been seen to come from them. We show also that the light from these openings extends in an immense dome, reflected from the Martian atmosphere, high above the surface of the planet. And then we show, in connection with the aurora of the earth, that the auroral light, so called, is precisely the same thing. Then we demonstrate conclusively that the earth, like Mars and the other planets, has its polar openings, too, because the polar regions are much warmer than the northern latitudes through which one travels to reach them. We show how warm currents come from these regions and how animal life takes refuge in them as breeding and feeding grounds. The picture of the earth that we draw is not an imaginative construction, like Symmes' with such things as "mid-plane spaces"--whose existence is not backed up by any observed fact. No, our picture of the earth is one which is all through based on observations. The light and warmth of the interior regions we claim to come from the central sun whose rays stream out and form the aurora and whose heat warms the water that comes over the lip of the orifice in the life-giving current that every Arctic explorer has observed and marveled at. From this warm interior, too, come the mammoth and other animals and birds which the explorers have noticed with such wonderment. From there come the mysterious pollen of unknown plants and the seeds of tropical trees--for it is tropical vegetable life that we shall find in. that hot, moist interior. This picture of the earth fits in with every scientific fact which has ever been discovered, and there are no scientific facts which contradict it. Could Symmes say as much for his ideas?

After all, where Symmes made deductions about the law of gravity and the nature of things in general--things about which even now, almost a hundred years later than Symmes we know very little--all we do is ask people to use their eyes. Every point that establishes our theory rests on something that can be seen with the eye. The appearance of the nebulas can be seen, and the progress from one stage of evolution to the next can be compared. The light from the Martian interior sun has actually been seen and recorded. The animals of the north have actually been observed traveling north. The warm current from the North is tested for its temperature by the thermometer; its

direction checked by the compass. The mammoth is not only seen but its freshness is tested by eating. And so it goes. Such mere arguing as Professor Dominian brought to bear against our theory will never refute it because our theory does not rest on argument; it rests on observed facts. The only way scientists can refute our theory is by answering in a way fully as conclusive as ours and free from self-contradiction, all the questions which we ask them in our concluding chapter. As these questions never have been answered satisfactorily by scientists, as the efforts to answer one involve theories which are contradicted by the efforts to answer another, it is obvious that the scientists are baffled, and they will remain baffled as long as they ignore the guiding principle or guiding fact call it whichever you will--that binds all these appearances together and makes them agree one with the other.

And between this carefully based picture of the earth and the planets as close observation reveals them to us, between this sober and scientific theory, and the fantastic theory of Symmes there is nothing in common. Only ignorance and prejudice or sheer dishonesty could ever make out that our theory was a rehash of Symmes' theory. For in truth they are different in their inceptions, in their methods of argument, and in their final results.

CHAPTER XX. THE MOON AND OUR THEORY

How on our theory do we account for the moon and what do we claim to be its structure? We may answer those questions wholly in the words of the orthodox scientists and the answer will show how inevitably all real research into the structure of the heavenly bodies fits into the facts as we have discovered them--and this fitting in of every separate fact is the conclusive demonstration of the soundness of our ideas. Many theories fit some of the facts. Almost any theory is thought to be true as long as there are no facts to contradict it. But that is not enough. If a theory be true, every fact that can possibly be discovered will fit in with it.

WAS THE MOON HURLED OFF?

Now it would be quite possible that in the rotation of the hollow nebula which afterwards condensed to the planet Earth a nebulous mass might have been hurled off, perhaps owing to the attraction exercised upon it by a passing comet of large dimensions. Scientists, in fact, have said, in the past, that the hurling off of the moon from the earth--which they thought took place when the earth was in a fluid or plastic condition--that this hurling off was responsible for the depression in the earth's surface that formed the earliest ocean. But since that time astronomers are tending to abandon that theory and to give their allegiance to the "capture" theory. Professor See is the proposer of the capture theory, and by that expression he means that the earth captured the moon by its attraction; that the moon was a very small planet which came very near the earth and was deflected out of its path and caused to revolve around the earth instead. An article on Professor See's researches which appeared in the *Scientific American Supplement* for February 15, 1910, says:

THE CAPTURE THEORY

"Our moon, likewise, was originally a planet which neared the earth and was finally captured and made a satellite. It was no part of the terrestrial globe detached by rapid rotation, as has been generally believed since the

time of Anaxagoras, B. C. 500-428, and more recently taught by LaPlace, Lord Kelvin, Sir George Darwin, Poincare, Pickering, and other eminent writers."

Of course this is not absolutely proven, but astronomers base the conclusion on certain calculations which show, or seem to show, that the rotation of the earth was not of such a speed that a body the size we know the moon to be, would be thrown off.

We do not wish to decide that question, however, but simply to point out to the reader that if the moon is a captured small planet it ought--if it is true that a planet is a hollow body as we have contended--it ought, we say, to be hollow.

Now if the scientists themselves--not those who know of our theory, but men who wrote before our theory was published to the world--if these men, quite independently of us, were to say that the moon was hollow, would not that be a very remarkable confirmation of our theory? Would not any candid reader have to admit that we had scored a very strong point, all the stronger because we do not argue it ourselves but simply set down what the orthodox scientists are saying, and let it speak for itself.

SCIENTISTS ADMIT THE MOON HOLLOW

Very well, then. Let the reader turn to page 123 of Edwin S. Grew's "The Romance of Modern Geology". There he quotes from a book that Mr. Wells wrote about the moon. Mr. Wells made it the scene of a story but he wished to have a really scientific background for this tale, and, as Grew says, he "has gathered together all the more reasoned speculations on the subject". And the result of these speculations is that Mr. Wells came to the conclusion that there was not only some atmosphere on the moon but:

"There are gases of some kind on the moon. There must be gases, for example, shut up in the moon's rocks; there may be gases in the moon's interior.

Mr. Wells imagined that there was a good deal of gas inside the moon; indeed he went so far as to suppose that the moon was partly hollow."

And then Mr. Grew himself goes on to say that only in case Mr. Wells were right, only indeed if the moon were hollow could he explain what is known to be a fact that the moon is very much lighter in proportion to its size than the earth. Not only that but it is lighter, he says, "than we should expect it to be."

Why is that? Simply because being a much smaller spheroid than the earth its shell is proportionally thinner.

RELATIVE WEIGHTS OF EARTH AND MOON

It is obvious that if the earth and the moon were both solid bodies as the astronomers have thought, they would be of proportionately equal weights, for both being made up of the same substances the specific gravity of the one would be approximately equal to the specific gravity of the other.

Only on our theory that both moon and earth are hollow can this difference be explained.

And so whatever facts of astronomy or cosmogony the reader wishes to bring forward it will be seen that our theory fits them fully and links them up into one consistent body of knowledge.

CHAPTER XXI. A NOTE ON GRAVITATION

It has been objected against our theory that the weight of the earth is known and that it is much heavier than would be the case if it were hollow as we have claimed. At first glance that might sound like a plausible objection, but a moment's thought will dispel it. After all, weight is a purely relative matter. The same object weighs more at the polar orifice than it does at the equator because the pull of gravity upon it differs. Weight, the reader will remember is due to the attraction of the force of gravity and it varies according to the distance there may be between the object and the center of the force of gravity which is pulling on it. And as the force with which the earth attracts objects is the original unit upon which the whole idea of weight is based, it follows that we cannot use that unit to measure itself--we have to take it for granted. What scientists actually did when they "weighed the earth" was to assume, first of all that it was a more or less homogenous sphere. They then observed the force with which it exerted attractions on various bodies. But the amount of attraction which the earth exerts, say, on a pendulum, bringing it to rest in a certain time, is a fact which is not altered by showing that the earth is hollow. All we can say is that a lesser mass of earth than we had supposed is after all able to affect the pendulum. Or we can put it this way. We had supposed in the past that it took the gravitational force of a solid or semi-solid sphere the size of the earth to hold us on its surface against the centrifugal force which would tend to throw us off the surface of the earth owing to its fast rate of revolution. Nov some people argue as if the truth of our theory would reduce the gravity of the earth so that that centrifugal force would throw us all off the earth. But that is not so. All we have to do is to admit that the pulling force of the earth is greater than we had thought, for now it appears that a globe which is not solid but hollow--however, having a very thick shell--is sufficient to hold us by gravity against the push of the centrifugal force.

GRAVITATIONAL PULL IN THE INTERIOR

And one correspondent has even asked why the inhabitants, human or animal, of the interior would not be pulled into the central sun by the force of

its gravitational pull. The answer is of course, easy. In the first place the central sun is a very small body and its gravitational pull is therefore counteracted by the gravitational pull of the shell of the earth. And again, in the interior of the earth the centrifugal force tends to hold things down to the ground, because it is always directed from the center out at right angles, and its direction is therefore the same whether one is on the outside or the inside of the shell of the earth. When we are on the outside we are held down against its pull by the combined gravitational pull of the whole earth--shell and interior sun. If we were on the inside of the earth we should be held by the balance of the forces, the interior sun exerting a force of gravity on us which, if unopposed would pull us into itself, the gravitational pull of the earth's shell pulling us the other way, and the centrifugal force of the whirling earth adding to that pull by pressing us against the inner surface. For that reason if a man on the interior of the earth dug a hole--which would point the opposite way to a hole which we would dig on our surface, he would be likely to fall up, if he were careless, as we are to fall down a hole if we do not take precautions.

CHAPTER XXII. HOW OUR THEORY HAS BEEN RECEIVED

Before telling about the actual reception which greeted our theory when it was first propounded we wish to lay stress upon one particular point. Before the reader can intelligently accept or reject our theory he must make up his mind whether he is going to believe anything he is told as long as it comes from a scientific source--so-called--or whether he is going to claim the privilege of using his own commonsense. In other words, he has to decide this question: "Is a thing true just because it is supposed to be scientific?"

Some people worship science and believe everything that is said in its name, and if we rub counter to science they will have nothing to do with us or our theory. One of our critics, in a letter, said: "The fabric of our modern conception of the universe has grown too slowly and painfully to be overthrown at a blow".

And a professor of geology writes that "scientific men who are competent to deal with the subject. . . . will tell you that the book is a great joke."

Here is a third expression of the same point of view; from a celebrated American astronomer: "Mr. Gardner seems to me to have no conception whatever of the thoroughness with which scientific men work or of the requirements of proof of a theory before it may find acceptance. His theory runs counter to many of the foundations of mechanics which are as thoroughly established as anything we know, and in my judgment cannot possibly be true."

Nov those opinions certainly sound as if scientists were so thorough and careful that they never made a mistake and as if what they said had to be accepted by the layman without any attempt to criticise it. But I shall proceed to show that scientists do not live up to those pretentions at all. They are just as much in the dark, just as much at loggerheads, one with another, just as apt to err sometimes more apt--as the rest of us.

What, for instance, do they really know about the constitution of the earth? What is their latest word on the matter? Do they all agree about it, as

those letters just quoted would imply that scientists agree?

Well, here, taken at random from the latest pronouncements of scientists are three views of the constitution of the earth which certainly do not agree with one another and which some people would say differed from one another, among other differences, by one being more ridiculous than another. Of course there are many other scientific theories, different again from these. They are mentioned in other parts of this book. But we select these for mention simply because they are the latest, and show that the scientists are not getting any nearer a fundamental agreement.

Here is theory one. Professor Louis Rabourdin of France has recently said that the crust of the earth is very thin, and is especially thin at the bottom of the sea:

"Suppose," he says, in a recent despatch, "that following an extraordinary twisting movement, due to a retreat of the central mass, a large mass of the sea bottom, should give way, and, falling suddenly, should let in the mass of the ocean's waters upon the incandescent interior matter. The water would be decomposed by the heat, the hydrogen would burn, and it would burn more as it had access to more oxygen."

And the pessimistic professor goes on to picture the whole world being burned up in a flash, and appearing to other worlds in space as a momentarily blazing star.

Well, it has not happened yet, and we fear that if the professor is looking forward to such a very expensive proof of his theory as the burning up of the whole world, including all the people who would have been convinced by the phenomenon--we fear that he has a long time to wait.

But if that prospect alarms the reader he may have another theory with a little bit more hope of stability in it. For here comes an American professor, Dr. A. C. Lane of Tufts College, and says that the earth is not a simple envelope of crust containing a fluid interior as this French scientist evidently thinks, but that it is, in constitution, very much like a butter-nut. (And yet some people call our theory ridiculous!) But professor Lane's earth at least has the advantage that a break in the shell does not cause a complete world conflagration, as the reader will see from the following words:

"The outermost layer of the earth's crust, as professor A. C. Lane, of Tufts College, says, is but a thin wrinkled shell like the outer husk of a butter-nut. The viscous layer just beneath this corresponds to the fleshy layer in the butter-nut; the earth's inner crust to the butternut's hard shell, and the gaseous center of the earth to the kernel of the butternut.

"In this butternut-like structure of the earth lies the reason why from time to time are collapses of the viscous layer of the earth, leading to elevations of portions of the outer crust. These collapses are what have produced the mountains etc."

Does the reader see the difference between the two theories? That extra crust that gives such an air of safety to Professor Lane's earth? And yet the scientists object when we appear with a theory and tell us that no new theory is wanted as they are all in agreement and making good without us.

But after all there are some things about the earth that looking at a butternut will not explain, and along comes Professor Garrett P. Serviss, and tries his hand at a better theory still. In an article widely printed throughout the country in 1915, Professor Serviss begins his consideration of the subject by asserting that in the days of primitive man the Great Polar basin or depression was his home, and that at that time the polar regions were tropic. Of course he is led to say this on account of the finding of mammoths in Siberia--something which we have already explained. He next points out that the Antarctic continent is very high, some of the highest mountains in the world, he points out, being in the Antarctic regions. Why, he then asks, should there be this depression at the north pole and this high land at the south pole? (He forgets that phenomena of animal life, pointing, to a polar opening, having also been found at the southern extremity of the earth.)

Now the reader may gasp at what comes next, but Professor Serviss actually supposes that the whole central core or axle of the earth slipped out of position--just as a piece of loose lead might slip out of a stub of pencil--leaving a great depression at the north polar basin and sticking up from the surrounding surface of the globe at the southern extremity! One reason he gives for this strange theory is that the center of gravity is not fixed but that the earth "wobbles" in its rotation in a manner that would suggest that the center of gravity is no longer in the center of the sphere but that it is moving

up and down in the north and south axis. Of course the truth of the matter is, that these scientists study the question of gravity without knowing the exact facts and so they do not get the results they expect. And so in order to explain the lack of definite results that would fit in with their previous ideas they are forced to tell us that the central core of the earth is slipping out, by way of the south! What an idea! Here is what Serviss actually says about the matter:

"The central core of the earth is the densest part of the globe. It has been thought that it may be composed almost entirely of heavy metallic substances, mostly iron. Slight vibratory motions of this dense core would produce a corresponding shift of the center of gravity . . . . . .

"The depression around the North Pole, produced by the retreat of the underlying support, and the corresponding uplift about the South Pole would leave the Earth's crust at these spots practically as it is today."

The propounder of the theory admits that:

"A weakness of the theory is that it offers no explanation to account for the shifting of the earth's central mass along the line of the axis. But it may be pointed out that the same difficulty applies to the known variations in the location of the center of gravity. An attempt (which does not appear satisfactory) has been made to explain the latter as due to annual alterations in the amount of snow and ice accumulated around the Poles. But the main cause remains hidden."

Now that sounds pretty weak. First, the theory is most far fetched, and then it assumes things about the interior of the earth that other scientists deny--as we have already seen--and then it admits that it cannot explain all the facts but gives the excuse that it is no worse than many other theories in that regard.

And yet these scientists keep a straight face before the public, never openly laugh at each other, but always laugh at an outsider who ventures to show up their inconsistencies and proposes better theories, backed up with more facts, than theirs.

We will give two more examples. The celestial body nearest the earth is the Moon, and one would think that the scientists ought to be able to agree, in the main at least, about its character and the forces which caused it to be

where it is. Let us see how well and thoroughly they have solved the riddle of the moon and how closely they agree about it.

First let us call upon Messrs. Nasmyth and Carpenter whose book, "The Moon Considered as a Planet, a World, and a Satellite," is one of the standard English works on the subject. The first thing they have to tell us only concerns the moon incidentally, but it shows how scientists guess to obtain their results. Buffon, before LaPlace, wondered how the solar system was formed, and he guessed that comets used to hit the sun obliquely in passing it, and that each comet knocked a piece off the sun which thereupon became a planet and began to revolve around the sun. He then assumed that in some cases the stroke was so oblique that not only the planet but one to two or three small pieces were knocked off which became satellites to the planet, and that is how he accounted for the origin of the moon. Pure guess work, and they are still guessing.

But how about the present state of the moon? These authors tell us that by the study of the refraction of light that is reflected from the moon's surface it has been established that there is practically no atmosphere on the moon's surface. There is some but it is so slight that its pressure would be only one-half of the pressure of the air that is left in a vessel which has been exhausted by one of our best vacuum pumps--that is to say an atmosphere two thousand times rarer than our own. And, he goes on to say, if there is no air on the moon there can be no water, for if there were the water would vaporize and give an atmosphere of water vapor.

Well, the reader may say, that sounds reasonable. So it does, but listen to this. It is an account from Boston, Mass., of the latest theories of Professor Pickering of Harvard--a world-wide authority. It says:

"According to Professor William H. Pickering of Harvard, who recently made a study of the moon from an observatory in Kingston, Jamaica, there are evidences of the existence of a race of superior beings on the moon.

"Professor Pickering asserts a careful study reveals vegetation in spots on the moon's surface.

"This vegetation appears to spread along what looks exactly like two twin artificial canals, similar in character and appearance to those on Mars called

man-made by the late Professor Percival Lowell.

"These moon canals, Professor Pickering points out, are not less artificial in appearance than those on Mars."

So, dear reader, if you are going to believe the scientists you will have to try hard to think at the same time that there is no air and no water on the moon but that there are a very superior race there who indulge in truck gardening along the banks of artificial canals. They would certainly have to be a "superior race" to do that. Perhaps if we could get a few of them down to earth they could raise watermelons on the Sahara desert. But perhaps it is only artificial flowers that they grow along the waterless canals in a land where the vegetation is never injured by storms because there is not any air to create winds.

And yet these scientists always keep their faces straight and never appear to laugh except at pre-sumptuous outsiders.

Well, perhaps our last example will cause the reader--just for the sake of turning the tables--to laugh at the scientists. Have you ever been sun-burned, gentle reader? In all probability you have. And if so you have certainly made some remarks about the heat of the sun. You have certainly been brought up--have you not?--in the idea that the sun was about the hottest thing we know of in our universe?

Well you may be surprised to learn that as late as the nineteenth century Sir William Herschell thought that there might be people living on the sun. He thought it was a cold body--a dark orb surrounded by fire-emitting clouds. Now why, if the clouds are white hot the sun itself should be cold, is a question that Herschell being no longer among the living, cannot answer. Of course, it was the sun-spot which caused him to think that the sun was dark and cold--the black sun-spot showing through a rift in the incandescent envelope. But it does not seem to have occurred to him that there could be any other explanation and that a white hot cloud envelope would very soon heat the sun almost to its own temperature, and quickly kill off any life that there might be on its surface. Herschel's answer to this objection was a flimsy one. He said that there were two layers of cloud, "the outer," says Proctor in discussing the matter, "self-luminous and constituting the true solar photosphere, the inner reflecting the light received from the outer layer, and

so shielding the real surface of the sun from the intense light and heat which it would otherwise receive."

Proctor goes on to say (in his book, "Other Worlds than Ours") that later discoveries shake Herschel's theory very much, that while later scientists admit his theory about cloud envelopes, they do not admit that the sun is cool, but explain the dark spots by saying that it is the very height of the temperature, so much above anything we can conceive of, that causes them to be black--because those are spots which do not part with their heat at all, and so no radiation comes from them to us. At least that is the present explanation of the matter, but how long will it be before scientists give us some other explanation?

Nobody knows, for what science will say next depends a great deal on the imagination of the scientist, and one can never predict the next direction of the human imagination.

But here is the point: What passes for scientific certainty is really a mass of guesses some of which have been verified by experiment but a large number of which have not been so verified and which have no real standing whatever. As soon as an outsider comes along with a new theory the scientists are so anxious to defend themselves against this "non-union" intrusion that they forget that they are only guessing half the time, and exclaim: "We have proved this, or that". Well the above quotations show that a good deal of the time they do not prove things at all. They make a guess and then hope that some observation or experiment will be made to support it. Sometimes they guess luckily and sometimes they do not. But the talk about great accuracy and laying foundations which can never be overturned is all a bluff. The foundations of science are constantly being altered. Like the foundations of a house they settle sometimes and then something has to be done to keep the house from falling to one side.

It is reason whose foundations are never upset. And we claim that our theory is reasonable. Whether the scientists are always reasonable or not the reader probably has already determined after reading the above extracts. And now we may pass on to the main question of this chapter: "How Our theory has been received".

Whenever a new and revolutionary idea is launched upon the world it is

received with ridicule, misrepresentation, distrust, and unbelief. Columbus was thought to be a fool; Galileo was persecuted, great liberators of the people have been mobbed by the people they sought to help; in short, all those who have helped to save mankind have first been vilified and sometimes killed, and then, years after, statues have been erected to their memories.

WHAT WE EXPECTED

The above general law of human life is known to every reader and we need not bother him with any further instances of it. When, therefore, we put forth the preliminary presentation of our theory in a much smaller book than the present one, with only the outstanding pieces of evidence set forth, we awaited with what calmness we might, the public response to our challenge. We knew that we had accused the whole body of astronomers, geologists, explorers and naturalists of being on the wrong track; we knew that we had thrown down a challenge to science, and we knew that the presumption of a layman in doing so would be resented by all the scientists and that the newspapers, taking their cue from these men and interviewing them, would print many an article in which endeavors would be made to pick our work to pieces.

OUR ACTUAL RECEPTION

Our theory did begin to attract attention, and the attention was of such a nature that it is reasonably certain that had the European War not turned the attention of Europe from every other subject of human interest and concentrated it upon that of slaughter--it is certain that if that had not been so our theory would by this time have been proved.

For what happened? Were we ridiculed and misrepresented and then ignored? Did we receive only adverse criticism or contemptuous silence? From one source or another we may have received ridicule. Some people have tried to misrepresent our theory. But when we look over all the response we have received to our efforts we are simply amazed by the generally open-minded and fair way in which our theory has been received. It would seem from this reception that the time is ripe for just the discovery we have made.

Even the monarchs of European countries, generally supposed to stand only for what is accepted and conservative, have expressed interest in our work and read it with open mind.

EUROPE MORE OPEN-MINDED THAN AMERICA

Professors in the universities of Europe, especially those where interest in Arctic studies is a feature of the intellectual life, have written us in terms of great interest. It is only in America that the university professors adopt a dogmatic attitude of denial of our theory. Of course many of our correspondents are kept from full acceptance of the theory only because they believe that the poles have actually been discovered. But when they read this enlarged work they will have that stumbling block removed, for as we have conclusively shown Peary and Cook did not reach the North Pole and the methods of observation are so unsuited to navigation in the Arctic that any position on the surface of the curve of the orifice is likely to be mistaken for a polar position.

We will now proceed to give a few out of the many replies we have had to our ideas and comment briefly upon some of them.

THE KING OF SWEDEN

From His Majesty, the King of Sweden, we received the following letter:

"Secretariat du Roi. "Stockholm, Nov. 17th, 1913.

"Sir:

"His Majesty, the King of Sweden, has directed me to thank you for your letter of October 20th inst. and for the book, 'A Journey to the Earth's Interior or, Have the Poles Really Been Discovered?' forwarded with the same, and which His Majesty has had much pleasure in receiving.

"Sincerely yours, "W. Bostrom, "Private Secretary to the King."

THE KING AND QUEEN OF ITALY

From the "Consolato di S. M. it Re D’Italia"--the Italian consulate in Chicago, we received the following letter:

"December 12, 1913.

"Mr. Marshall B. Gardner, "Aurora, Illinois. "Dear Sir:

"The Ministry of the Royalty has written this office acknowledging receipt of your publication, 'A Journey to the Earth's Interior, or, Have the Poles Really Been Discovered?'

"Their majesties wish to express to you their sincerest thanks for your homage, assuring you that the book will be read with much interest.

"Very truly yours, "G. Butignini, "Royal Italian Consul."

A CELEBRATED SWEDISH SCHOLAR

From one of the foremost Swedish scholars, Professor Hj. Sjogren of the Riks Museum of Stockholm, we received the following letter:

"Stockholm, 9 Februari, 1914.

"Dewey Publishing Company, "Aurora, Ill., U. S. A. "Dear Sir:, "I had the pleasure to receive a copy of Marshall B. Gardner's book 'A Journey to the Earth's Interior,' etc.

"I must say I was struck by the originality and audacity of the Gardner theory and will read the book with great pleasure.

"Yours very truly, "Dr. Hj. Sjogren."

ADMITS OUR ORIGINALITY

We wish particularly to point out that Professor Sjogren admits the originality of our theory as several people in our own country have apparently read our book so carelessly that they confuse our ideas with the purely speculative ones of Symmes or the mystical writings of Koresh. But such an endorsement as this from so eminent a scholar should at least settle the question of our originality. For Professor Sjogren at least knows all the

history of the different theories regarding the conformation of the earth. And while we do not expect instant conversion on the part of every scholar who reads our preliminary book, we do think it fair to point out to our less distinguished and usually less considerate critics that the tone of admiration for our work and respect for our thought which this courteous letter shows is sufficient warrant for other people at least doing us justice and not confusing us with a totally different order of people. Our theory is to be judged by scientific standards and not merely dismissed as a dream.

AN AMERICAN SCIENTIST

Now let us contrast the open-mindedness and scientific fairness of this Stockholm scientist with the sort of thing that we receive from our own countrymen. We shall take up in detail later an attempt by an American scientist to shatter our theory, and we shall show how easily his own arguments are shattered. But this instance is not of an attempt to out-argue us--that we would welcome, but of sheer narrow-mindedness and misrepresentation. The letter is from The Lick Observatory of the University of California:

"Mount Hamilton, Nov. 18, 1913.

"Dear Sir:

"Answering your inquiry of November 11th, I beg to say that your book, 'A Trip to the Earth's Interior' which you sent as a gift to the Lick Observatory, was duly received.

"It may be a disappointment to you to learn that we are placing your book in the class which contains pamphlets which we perennially receive on such subjects as 'The Earth is Flat,' etc. It is surprising how many of these contributions there are which ignore, with apparent deliberation, the great body of modern scientific knowledge.

"Yours truly, "W. W. Campbell, Director."

SHEER MISREPRESENTATION

If that is not a sheer attempt to misrepresent our theory we should like to

see one. But why the Di-rector of the Lick Observatory thinks he can misrepresent the theory to the very man who is responsible for it is a matter that we cannot begin to explain. He must himself have ignored with "apparent deliberation" all of our book except the title page. In that book we did not give as great a volume of evidence as we have now collected but every bit of it was composed of "scientific knowledge." We challenge Mr. Campbell to point out anything in that book that is not based on science or that ignores scientific results. We quoted Percival Lowell. Is he not a scientist or is the director of the Lick Observatory jealous of him? Are not all the Arctic explorers from the earliest days scientists? But why trouble further about a man so narrow-minded that he does not even read a book before condemning it? Let us pass on and leave Mr. Campbell to his library of pamphlets on "The Earth is Flat," etc.

SIR ARTHUR CONAN DOYLE

Although he is not a scientist by profession one of the most scientifically-minded men in England is Dr. Arthur Conan Doyle. Although best known as a novelist Dr. Doyle is a trained medical man--which means that he has had years of scientific discipline. He has also studied the laws of evidence in many of his investigations into psychological subjects, and he has read widely along geological lines in his search for material for some of his romances. If anyone could detect any flaws in the evidence for our theory Dr. Conan Doyle would be the man, for his whole series of Sherlock Holmes detective stories is based upon the application of logical processes to the study of facts--and he has told us that he learned the methods from an old medical teacher. Dr. Conan Doyle was the recipient of a copy of our preliminary book, and he immediately wrote to us in highly flattering terms. The one objection he raises to our theory has already been dealt with in the course of this book, and so we need not refer to it again. But, that objection apart, does it not seem absurd for people like the Director of the Lick Observatory to dismiss our theory without reading about it when a man of the international reputation of Dr. Conan Doyle writes as follows:

"Dear Sir:

"I read your little book (and big theory) with great interest. It is so very original and actually explains so many facts, that if it were not that both poles

had actually been attained, I should be a convert. But I must thank you none the less for a most interesting exposition.

"Yours sincerely, "Conan Doyle."

WEIGHT OF OPINION

Surely a letter like that will cause some of our uncritical opponents to think again. Let us merely point out that the only test of a theory such as ours is "Does it explain the facts?" and Dr. Conan Doyle answers that it does explain very many facts meaning facts which have hitherto not been explained. Now we have never heard that such theories as the one that the earth is flat explained any facts. They are simply notions. And here is a direct admission by a competent witness that actual facts are explained by our theory. Such recognition as this is all we ask. Simply a square deal and the acknowledgement of the impression that our theory makes on the reader's mind and reasoning faculties. But from people who dismiss our theory before reading it we are not particularly anxious to hear. We welcome constructive criticism. But mere fault-finding will do no good. Our ideas must be answered by their opponents or those opponents will simply show themselves up for narrow-minded people who refuse to think outside their own ruts.

TWO AMERICAN PROFESSORS

As we have indicated, the professors in those countries nearer to the Arctic regions, countries from which expeditions have set out from the earliest times, are far more hospitable to our claims than are American scientists.

Professor Joseph Barrell of Yale--who has evidently not read us--says that our preliminary book is "absurd" and in a class with "those which contend that the sun is inhabited and the moon likewise." That, of course, is an utter misrepresentation of our theory and method of proving it. Even this ultra-conservative scientist is impressed with the work, however, for he says it is "interesting as an effort of the imagination." That very sentence, however, shows that he has not understood our work, for there is no imagination in it but only reasoning. Had we simply invented a theory as Symmes did, imagination would be a good word to apply to it. But where every step is taken only on the basis of ascertained fact it is absurd to talk about

imagination and to compare ours with books regarding inhabitants in the moon and sun.

CONTRAST THIS FAMOUS RUSSIAN GEOLOGIST

Now contrast with the absolute misrepresentations of Professor Barrell, the tone of a letter which we have received from Professor Bugdanovitch, who in 1914 was professor of geology in St. Petersburg. He did not profess conversion to our theories--and this we would not expect to be universal and instantaneous, but he wrote us complimenting us not only upon the "beautiful style" of our work which he compared to the writings of Jules Verne, but upon the fact that it was written very logically. And he also admitted that we had caused him to realize the many unanswered or unsolved questions that the orthodox scientific view of the earth had left unsolved and that were made soluble on the basis of our theory.

And at this point it may be well to say also that Professor Dr. A. Schmidt, Secretary of the Hofrath, and Professor and Director of the Central Meteorological Station, Stuttgart--a world wide authority on the sciences relating to the earth--writes us that "after having read it with enthralled interest I find that in it a very weighty physical hypothesis was stated. . ." and the professor ends his letter by a wish to discuss the theory further in the future.

But we may be pardoned for stressing what he has said on his first reading of the preliminary book; that our hypothesis is weighty and is a physical one--that is to say is a scientific one based on observation, and not a mere speculation. It is this fact, that ours is a physical or scientific hypothesis, that we have such a hard time to make the American professors see. Just because they have heard of cranks who have thought the earth was flat they assume that any theory coming from a layman, no matter how well supported, is in the same class. We should think that Professor Barrell of Yale, if he ever reads this letter from Professor Schmidt, would blush at his own absence of tolerance and courtesy.

EXPLORER WOULD HAVE TESTED THEORY

But one of the most startling communications we received was from

Professor J. Bohm of Berlin, and it indicated that the author meant to put our theory to the actual test of exploration. But he wrote to us on the subject just before the Great War broke out, and naturally that put a stop to all European activity along exploring lines.

Professor Bohm thanks us for the copy of our preliminary book, tells us that our theory is clearly and logically presented, that the illustrations aid in making clear just what the constitution of the earth is. And he would like to point out, he goes on to tell us, that there is a splendid chance to prove our theory through an Antarctic expedition which is shortly to set out from Austria under the leadership of Herr Dr. Felix Konig. He informs us that Dr. Konig lives in Vienna and urges us to get into immediate touch with him.

But before we could take advantage of this the World War had started. We made no effort to communicate with Dr. Konig because we knew that it would be quite useless. It is certain that no Austrian exploring expeditions will sail anywhere for a long time to come. But our readers will certainly agree that the fact that a well known scientist should be enough interested in our theory to suggest such proof of it is an important point. It shows how seriously our theory is taken by the scientists of Europe. We hope that the scientists of our own country will soon learn to give it as serious attention.

FROM THE PRACTICAL MEN

It is interesting to note that the practical men, that is, the men who use science as well as merely know it--engineers rather than professors, are more apt to take kindly to our theory than the men who are not practical. For instance, Mr. H. M. Chance, the consulting engineer of Philadelphia, Pa., says:

"Mr. Gardner is, in my opinion, justly entitled to much credit for having conceived and elaborated such a theory. . ." although the writer admits that he does not feel "competent to express an opinion on many of the features of the theory he elaborates"--a modesty which is entirely wanting in nearly all the American university professors who seem to know so much that they can dismiss our theory in a few dozen words.

A SCIENTIST WHO TRIES TO CONFUTE US

As a matter of fact there is a very good reason for this attitude on their part. One of the representative scientists tried the other way--to refute our theory in detail. He was the only one of the whole professional fraternity who came out in print and tried to demolish our theory. He had all the facts of science to draw upon. He had access to all the scientific works in our university libraries, and he was an expert in geographical and similar questions. His defeat was so final that no other scientist has come out into the open and criticised our preliminary book. It was Dr. L. Dominian of Pittsburgh, of the staff of the National Geographical Society, who answered us on behalf of orthodox science, and we shall give his attack in full and our reply to it in a chapter to themselves--which will follow immediately after this one.

But in the present chapter we wish to show the general tone of the reception which was accorded our theory not only by the people already mentioned but by private individuals and by the press.

WHAT PRIVATE INDIVIDUALS SAY

Correspondence from private individuals reveals a general tendency to accept our theory except for the one point that these individuals make about the poles actually having been discovered. In the present work we take up that point at length, and we meet fully that objection.

QUESTIONS ABOUT THE CENTRAL SUN

Other individuals write us for further information on points that we could not possibly know anything about. In fact, to read some of these letters one might imagine that our correspondents thought that we had actually been in the interior in person and had had the latest scientific instruments with us. For instance, one man wants to know how the inner sun keeps up its heat, and what its temperature is. To take the latter point first, all we can say is that its temperature is such that the interior as a whole, is, on its surface, of a warmth sufficient to support tropical vegetation. We know that, not because we have been able to measure the heating power of the central sun, but simply because we know that the vegetation exists; we have seen it, as the pages preceding bear witness; we have seen where it comes from, and we know what are the

approximate conditions under which it will grow. That being the fact the question of how hot the interior sun is and that of how it maintains its heat can well be allowed to rest until direct observations are made. But, says the reader, may the central sun not cool to the temperature of the surface of the earth and so fail to warm the interior any more? The answer is that such is not necessarily the case. At one time scientists thought that all suns would eventually cool off and so all planets some day fail to receive their quota of light and heat. But it is now thought that suns are kept alive--so to speak--by their supply of radio-active elements which decompose and give out energy all the time and so keep up the temperature of the suns. And this may well be the case with the central sun. But the reader must remember that we are not trying to dogmatize about the matter. In the past pages we have told not what the central sun is like in all its details, but simply what it does. It warms the interior of the earth and we have abundant proof of its action. That is all that can be required of us at this stage in our study of the matter. When we actually penetrate to the interior there will be another tale to tell.

A CHICAGO WOMAN GREETS OUR THEORY

On the other hand we have a letter from Mrs. Maude L. Howard, of Chicago, which voices another interesting reaction to our theory. Mrs. Howard says she felt, when she read our preliminary statement, as if something had been said which explained and cleared up matters and appealed to independent thinkers. She was so interested in our view that she wrote encouraging us to push our investigations further, and gave us her own views on the possibility of the interior being inhabited by a race of people, perhaps further advanced in evolution than we should expect. That, of course, is a matter of speculation, but it is such suggestions as this, coming from people who do their own thinking, that will gradually raise general discussion of our theory and get the public at large interested.

And whether people agree with us in every detail or differ from us, we are equally glad to hear from them. We want the common sense of mankind to join us in this matter and to aid in solving the many questions that can only be solved when adequate expeditions go into the interior. And the more discussion there is about our theory the sooner that will be.

A PROMINENT CANADIAN PHYSICIAN

Dr. L. Secord, a prominent Canadian physician, writes us that he read our book with interest, and speaks not only of the ingenuity of our theory but of the necessity for receiving it with an open mind. "It does not do for us," he says, "to set aside a proposition without giving it due weight and consideration" in these days when so many wonderful discoveries are being made every day. He adds:

"There is many a world within a world even within our own bodies, the truths of which science is gradually unfolding."

A LIBRARIAN CONFUSES US WITH SYMMES

Of course we have also received some letters which show a very great lack of intelligence. One was from the librarian of a Massachusetts library who had bought a copy of our preliminary work and wrote in to the publisher that the book was not what it pre-tended to be. He went on to explain at great length that our theory was simply a restatement of Symmes' Theory of Concentric Spheres, as if we had never heard of that theory before he explained it to us. Of course we knew all about Symmes Theory and of course it is nothing like our theory either in its formulation or in its method of proof. But that point we have discussed elsewhere in this book and so we need not repeat ourselves here. But we hope that our readers will keep the distinction clear between our scientifically proven theory and Symmes' purely speculative and imaginary account.

An open-minded scholar who has received our theory without prejudice is Professor J. W. Searson, of the Kansas State Agricultural College. Perhaps the most valuable point in Professor Searson's letter is that he deals with the question of originality. We take especial pleasure in quoting this letter, so that an independent witness may vouch for the fact that our theory is an original one, standing on its own feet and honestly built up on the facts--not a copy of anyone else's theory. Here, then, is Professor Searson's letter:

Kansas State Agricultural College, Manhattan, Kansas, March 22, 1917.

Dear Mr. Gardner: Permit me to express to you my sincere appreciation of

your kindness in presenting me a copy of "A Journey to the Earth's Interior." I have read the book with keenest interest and confess that it is the most unique discussion of the composition and shape of the earth that I have ever seen. I used to be greatly interested in the theories of Ferguson and many similar discussions. I have found your book intensely interesting, cleverly written, and absolutely original from beginning to end. I have worked so long in another field that your entire discussion is absolutely new to me. I appreciate it, however, and am very grateful to you for giving me this opportunity to read so unique a discussion.

Very gratefully yours, J. W. SEARSON.

Many of our correspondents have endorsed our theory to some extent but have met certain difficulties in thinking the matter out and have written to us for further particulars. Among these, for example is R. M. Keminski of Chicago, who, after seeing the preliminary book about our theory, wrote in a number of questions which showed intelligent thought in regard to the matter. Our correspondent will find that all those questions have been covered in the present work and convincing answers given to them.

THE "SCIENTIFIC AMERICAN" COMPARES JULES VERNE

When the preliminary account of our theory was published it attracted a great deal of attention in the press, although all of the attention was not of the most intelligent kind. We were gratified to find that the foremost American scientific journal, *The Scientific American*, treated us with a great deal of respect, although its editors did not take upon themselves the responsibility of committing their paper to the new theory. The reviewer of our book in the columns of that journal gave a very fair summary of our theory, and of its presentation he had this to say:

"The sheer ingenuity of his arguments makes the little book worthy of the Jules Verenean reader." And he praised us for the "wealth of details" with which we worked out our ideas.

Another very appreciative review from the scientific standpoint was printed by the *Buffalo Medical Journal*, one of the oldest and best known

medical periodicals in the country. The reviewer says, among other things:

"Mr. Gardner's hypothesis is so alluring in many ways, practical as well as theoretic, that we are inclined to express the hope that the discoveries of the poles will prove incorrect," Now that is precisely what we show in this book--that Peary and Cook have both been absolutely proved incorrect on their own showings. And we shall await with interest what the *Buffalo Medical Journal* has to say when its reviewer reads our proof in the present volume.

A WRITER ON THE CHICAGO DAILY NEWS

Among the less intelligent reviewers was a writer on the *Chicago Daily News* who gave a summary of our views and then suggested that any explorers of the interior would need to take plenty of heavy clothes, as "the weather is a bit chilly in the polar regions at certain seasons of the year." Evidently he did not read our book with much care. For we have shown that the worst weather in the Arctics is that experienced some distance south. When the explorer reaches the regions of the polar orifice he finds that the weather becomes warmer. Once one was in the interior one would wear just the clothes that one wears in the tropics.

But this reviewer makes up for the inadequacy of that remark, however, by adding:

"Seriously, Mr. Gardner's theory offers some explanations of certain phenomena, as the Aurora Borealis, the Aurora Australis, the magnetic poles, the dip of the needle, etc., that are as plausible and satisfactory as those that are offered by sober science."

But if that is so, O scribe of the Daily News, why is our theory not just as "sober" as the science whose equal you admit that it is when it really comes to explaining things?

AN ADMISSION AND A DEMURRER

The San Antonio Express, like the *Scientific American* compares our book to the writings of Jules Verne for interest. The reviewer in that paper does us the justice to say that a reading of our book will convince the reader that:

"Schoolday teachings of the earth's being a body with a crust for the surface and a molten mass for the interior, were wrong."

And the writer goes on to summarize our theory, although he misunderstands one point. He seems to think that we have not explained how the polar apertures were formed and he speaks of the possibility that the Northern and Southern Oceans might disappear in whirlpools through the respective apertures. If he understood the enormous size of these apertures and the fact that the curvature of their lips was so gradual that one sails over it without noticing anything out of the ordinary, he would never think of the oceans' disappearing.

THESE COMPARISONS WITH JULES VERNE

But since these and other critics and writers of letters are so apt to compare us with Jules Verne let us ask what such a comparison means. Jules Verne was the greatest scientific romance writer who has ever Jived. He predicted the aeroplane; he wrote about things which at the time were believed impossible but which have since come to pass. He described submarines which were capable of crossing the Atlantic at a time when there were no practicable submarines working at all. And since then they have crossed the Atlantic. Now how did he do that? In the first place he had a wonderfully fertile and strong imagination. Through its fertility he planned out wondrous conceptions, and through its strength he super-imposed logical progression upon those conceptions, so that when once you took the first step with him, everything else followed in logical order, and the reader was kept interested by the logic. As long as he was immersed in the tale it sounded probable and he did not have any feeling of disbelief. A weaker man might have dreamed some of the dreams of Jules Verne but he would not have been able to sustain the logic of the unfolding.

Now then, let the reader ask himself: "Why our book caused nearly everyone who has expressed an opinion on it to compare it to the works of Jules Verne?"

There are only two answers. Either the author of this book is a great imaginative writer like Jules Verne or, if he is not, the power of his book must lie in the fact that he is telling the truth.

Now we make no claim to be of great imaginative and literary power. If we were we would doubtless be writing all sorts of romances just as Jules Verne did. Why then does our book cause people to compare us to Verne? It is simply because truth is always stranger than fiction, when you really study it. And we have told the truth in this book, the truth revealed by actual observation. Either the facts supplied the interest in our book or else an imagination like unto Jules Verne's did it. We deny having any such imagination. Let the reader think over all he has read. Was it not all composed of facts? Did we not just link up one fact with another? Did we supply any "imagination" or invention? Did we say anything that was not backed up with evidence?

And yet the total result is a book that reminds people of the work of Jules Verne because it is so interesting. Could anyone who was not a trained writer of romance compete with Jules Verne in his own field? Of course not. The fact that our book can compete with Verne is simply because it called on facts to make its interest. It is the truth that we found by thinking and comparing the facts which explorers discovered that makes our book interesting. We do not wish to be given credit for any other faculty except the plain, old-fashioned faculty of logic. We are willing to leave imagination and invention to the novelists and romance writers. All we ask the reader to decide is "Are we logical?" Do we present facts to support our conclusions? If we do, if the conclusions do not outrun the facts, if we have said anything that does not have a solid fact behind it, then our theory should be put to the test of actual exploration.

But one thing is certain. If the actual facts in the case did not all point to the one thing, we could certainly not have made up a lot of reasons for our saying what we do. And as we did not make up the reasons but found them, all we ask for is credit for logic and intelligence, not for imagination. We are not competing with Jules Verne but with the scientists.

And the reader who wishes to see how the scientists compete with us need only read the next chapter.

A RELIGIOUS LEADER'S ENDORSEMENT

We would like to call special attention to the open-minded manner in

which one American thinker has received our theory. As he is the leader of a religious denomination, and as such men are usually supposed to be more interested in the progress of their own work--and quite naturally--than in the advance of other people's ideas, it is with peculiar gratification that we record the open-mindedness and fairness with which Mr. Thomas Shelton of Denver, Colorado, has endorsed our effort to bring about a more reasonable view of the earth's formation. Mr. Shelton is the editor of *Christian*, a monthly magazine which is in the order of an advanced branch of religion, and he devoted two long leading articles to our theory when it was first brought to his attention.

In the first of them he says in part:

"Here comes another scientist saying that the earth is hollow."

He says "another" because, as he explains later, a Dr. Teed once taught that the earth was a hollow sphere and that we live in its interior. But Teed's theory, of course, is nothing like ours, and does not have the same sort of a basis. It is more a religious cult than a scientific theory, and we hope that we shall never be confused with Teed.

Mr. Shelton goes on:

"It sounds sensible to me. This scientist, Marshall B. Gardner, Aurora, Illinois, making the earth an almost living creature, breathing the breath of life in its interior, like all other living beings, and a sun at its heart always and forever shining with vibrations like radium.

"Why haven't we found the North and South Poles while searching for the poles? Because they are protected by ice caps which explorers have never been able to cross. If Peary had gone a little farther he would have been going South and would have gone through the earth and come out at the South pole or hole. If Scott could have gone on he would have come out at the North pole or hole.

"These holes or openings are fourteen hundred miles across; so these explorers could have gradually entered the openings and have gone through the earth without ever knowing that they had left the outside of the earth. The central sun of the earth is so situated that when approached it would have looked like a rising sun; and when left behind, like a setting sun; and yet it

never rises or sets, but remains forever fixed in the center of the earth, surrounded by a corona of ample depth.

"Of course there is no night in the center of the earth and the temperature is kept in an equable condition. The great ice-caps at the North and South openings keep the air purified as it flows through the interior of the earth. The central sun is light and life, and the anchor of the planet. Keeping it forever in its orbit as it sails around the great central sun on the outside. Nature is uniform in all of her laws, creates everything for the use and joy of living. The universe is alive and a light as a unit of units. . .

"The Bible and the ancients made the underworld hell. Maybe they had the whole thing reversed. . ."

Mr. Shelton then goes on to develop the suggestion that there may be a race of superior people in the underworld, and he also goes so far as to say that the people on the outside of the earth have some characteristics of a race .of outcasts. But we do not wish to appear as claiming to know more than we do know, and we hope no reader who may have first heard about us through Mr. Shelton's kindly notice will fail to discriminate between what we really do claim and any further suggestions which Mr. Shelton may make on his own responsibility.

Of course there is some evidence--see our chapter on finding men in the Antarctic and also our chapter on the Eskimo traditions of ancestors in the far away north--that there are men in the interior. And it may be that owing to the equable and warm climate and the abundance of food, that they are a superior race. But on the other hand they may simply be a different race with altogether different ways and living and thinking and so not to be compared to us. So we must leave the question open, especially as it will not have to be left open for long. Exploration will soon settle the matter one way or another.

Mr. Shelton then goes on to say that the author is one of the three men whose works have helped him most in his own thought during the year in which he writes, and he ends his article with these pregnant words:

"If you laugh at Gardner, don't laugh too loud, for since writing the above, Russian ships report the discovery of a new continent, and, beloved, there are other continents undiscovered. Some of these may be inside the earth. Sit

tight, but don't be too cocksure that you are right."

In a later issue Mr. Shelton tells of the great interest his first article aroused--of people writing in to him about it--and says again that the author of this book has given "a new thought, and it is good to think new thoughts about new things."

He adds that we have written scientifically:

"Gardner declares that all worlds are the same hollow spheres with a sun on the inside of each world. He speaks in scientific terms and gives his arguments as a scientist, and not as a mere speculation."

On another page of this same number of *Christian* a correspondent writes to the editor saying that the clipping from which Mr. Shelton first heard of our theory was sent by him, being clipped from the *San Francisco Chronicle*, and he adds that he agrees with the theory.

Some weeks after that correspondence in the columns of Mr. Shelton's paper, we received a letter from an old lady, for many years known throughout the northwest as a student and advance thinker, telling us that she had read of our theory as outlined by Dr. Shelton and that she would be glad to examine our views. We sent her a copy of the first outline which we had prepared of our work, and asked her to criticise it frankly.

In her reply, this lady, Mrs. Sarah Gifford of Ferry County, Washington, says that it is quite evident that our theory is not merely a variation of some other idea such as the Koreshan cosmogony by Dr. Teed, and continues: "The Gardner theory is not something to be laughed at it is a theory presented on scientific principles."

And she ends her letter by stating her belief that. the theory may very shortly be "proven to the world as a fact."

Will other readers of our theory do as so many of these friends have done--send accounts of it to editors of the papers which they read, and which they know are likely to give us a fair hearing? In that way the news of our theory will be disseminated much more quickly than if the reader simply says to himself that he agrees with us and then settles back to watch our progress in converting the rest of the world. If every reader did that our progress would

be slow indeed. But let every reader remember that this book propounds a practical question as well as a theoretical one. If we had written a book which applied only to the planet Mars, it would be all right to read it and simply add the new knowledge to one's memory and then let the matter drop. Only the professional astronomers would really be enough interested in the matter to discuss it at length and too incorporate it in their teaching. But the reader should remember that this book concerns his own life because it tells of a land, a whole new world, which his own country may explore, and which may render vast supplies of all natural products to the people who explore it. It is for this reason that we ask the active support of every reader, that no time may be lost in disseminating our information and discussing it. It will be the big subject of discussion when plans really get started for exploring parties, and every reader who wishes to be abreast of the times, who likes to be "in on" whatever is uppermost in contemporary interest, will do what this reader of Mr. Shelton's magazine did--write to his favorite paper about our theory. And will not every reader not only do that but think about it and communicate to us any ideas which he may have on the subject? If there is some fact that is not made clear, or if you see a further argument either for or against our theory, let us know. We already have letters from the foremost scientists of Europe and some in America, and we have letters from people who are not scientists but who know how to bring their common sense to bear on a problem. Let us add you to the list. We have letters and cards from every quarter of the globe, hundreds of them, in fact, coming even from far-off China and Japan.

WHAT THE WORLD'S GREATEST NEWSPAPER SAYS

One of the most sympathetic accounts of our theory when it was first propounded appeared in the *Chicago Sunday Tribune* of August 3, 1913. That paper devoted a whole page with illustrations to our first announcement of the idea that the earth is not what scientists have always taught, and we reproduce herewith a few of their remarks on the subject:

"Can it be possible that down in the middle of this earth there is another earth? That a few hundred miles or so away, separated from us by ground and rock and vapor and such things, there is a great country inhabited by a great race?

"Scientists innumerable have discovered life, vegetable and animal upon other planets. Long ago the seers and wise men peopled the heavens. Exploration has stretched out toward the truth in all directions save this one. It remains for an Illinoisan to lead us--in theory--in that direction, down, down into the earth's uttermost recesses and the wonders thereof.

"Marshall B. Gardner of Aurora, the scientist in question, does not say in so many words that people live in the middle of the world. But he makes a circumstantial case to that effect. It is his belief that there is a big sun in the earth's interior, that there are immense holes where the poles are supposed to be, and that the phenomena of the aurora borealis and the aurora australis are the result of the interior sun shining out through the polar holes.

SAYS THE EARTH IS HOLLOW

"The Aurora man who has spent twenty years in studying out his theory, asserts that the earth's interior, instead of being a molten mass of lava, as has been claimed by scientists for ages, is hollow and contains a central nucleus or material sun of about 600 miles in diameter. He says this sun is surrounded by a corona of ample depth which is enclosed within an envelope of atmosphere; that this atmosphere is surrounded by a vacuum, and that between this vacuum and the interior surface of the earth's crust there is another envelope of atmosphere the thickness or depth of which is approximately 200 miles, thus making the diameter of the earth between its two interior surfaces a distance of 6,400 miles.

"By adding to this amount 1,600 miles, or twice the thickness of the earth's crust, the diameter of the earth as measured from its exterior surfaces would be 8,000 miles.

"The author of this remarkable theory declares that instead of a north and south pole there is at each of these imaginary points an entrance to the earth's interior 1,400 miles in diameter, or a space sufficiently large when combined to provide an area ample for keeping the interior temperature of the earth in an equable condition. He says that all other planetary bodies are substantially of the same general form as is the earth."

CHAPTER XXIII. OUR CONTROVERSY WITH DOMINIAN

One of the first newspapers to recognize the importance of our contribution to the world's knowledge was the *Pittsburgh Leader*. In their issue of December 28, 1913, they devoted a whole page to an exposition of our theory, with illustrations of the earth and a portrait of the writer of this book. They saw that if our idea was to be accepted it must stand the acid test of discussion, and so they picked out the most expert man they could find among scientists to examine the theory critically and to demolish it if he could. The scientist to whom this task was given was Dr. Leon Dominian, of the staff of the American Geographical Society. So in his article on our theory we have what is in effect the official answer of the scientists of the country, and especially of those most interested, the geographers, to our ideas. If there are any scientific arguments that go counter to our theory Dr. Dominian knows them. If he fails to demolish our theory it may be taken as proved, for there are no secrets in science, what one man discovers is communicated to all other scientists through their periodicals and societies, and when it comes to a matter of generally accepted principles one scientist can talk for the whole body just as well as an- other can. Science rests upon a body of accepted doctrine, and when Leon Dominian speaks against our theory he is not uttering private objections to it, but is voicing the objections which all scientists would hold. And also when we answer Dr. Dominian we answer not an individual but the concerted voice of orthodox science. We will now proceed to give in full Dr. Dominian's attempt to demolish our theory, and after that we will give, word for word, our reply--a reply which crushed Dr. Dominian, for he never "came back" at all. Here, then, are his objections to our arguments. He begins by discussing the mammoth:

DR. DOMINIAN'S MAIN OBJECTIONS

"The matter of the presence of remains and of whole mastodons in the Arctic ice has been known to the world for more than a hundred years. It is acknowledged by all authorities in the subject that the region of the poles was at one time in the earth's history a tropical zone. It is believed that some

disturbance caused the axis of the earth toward the equatorial circle of the universe to change suddenly and to turn the tropical regions of the poles into their present conditions of a world of snow and ice. The mastodon were caught and preserved by the change, death coming instantly to those that have been found as whole bodies. Anyone who is not familiar with this explanation has not had much training in glacial theories.

CAUSE FOR RED SNOW

"As for the 'red snow' it is believed to be carried to those northern cliffs of ice from a great distance just as the yellow sands of the interior of the Desert of Sahara are swept through the air to Egypt where it covers monuments and buildings at times with a coat of yellow. All Southern Europe feels something of this same thing when the African simoon becomes the French mistral with its sand-laden air that comes from the Sahara across the Mediterranean to plague the people of the Midi.

"There is no special significance in finding the trunk of a tree from the Temperate zone in the Arctic Sea. The vagaries of floating objects are too common for that find to excite anyone's suspicions or cause such an incident to create a theory of a new world. As for the south-going current observed by Nansen, that may be due to the one questionable point in our knowledge of the polar regions--that is, whether there really exists a continental mass south and west of Peary's route to the Pole.

A CONTINENTAL MASS

"From observation of the tidal currents the scientists of the United States government believe that such a continental mass exists. If it exists its outposts may be Peary's Crocker Land of 1896, Keenan Land, the questionable Sanikov Land and the latest land sighted by the Russians as reported a few weeks ago. It is to discover the existence of such a continental mass that Stefansson has gone into the polar seas under the patronage of the Canadian Government.

"Roughly speaking, this continental mass is supposed to be north of Siberia and Alaska, and it is the only portion of the Polar regions that has not been explored. If Stefansson finds it some of the few 'popular' mysteries of

the Polar regions may be explained away, but none of them is likely to be found to come out of the center of the earth. The discoveries of Peary, Amundsen, and Scott at the two poles do not seem to have been taken into account by Mr. Gardner."

WE ARE NOT THUS DISPOSED OF

The Pittsburgh Leader thought that was a very conclusive answer to our argument, and it added on its own account a paragraph to the effect that all our arguments had been met by the studies which scientists had been carrying on "for years and years"--as if we did not know all about those very studies and quote them in our book. Also they played up in larger type a statement by Dr. Dominian to this effect:

"Geographers know two things about the poles to-day.

"The North Pole is within an area of open sea. Peary proved this.

"The South Pole is on a continental mass of rock and ice. Amundsen and Scott proved this.

"Scientists accept these discoveries as the final word in Polar exploration, so far as the general conditions existing at the poles are concerned."

As the official answer of science to our claims, the above remarks strike us as being very weak indeed. So let us now reprint the answer which we made at the time to Dr. Dominian's assertions--for they are assertions of belief rather than arguments. Our answer was printed in a prominent manner in the *Pittsburgh Leader* for February 8, 1914, as follows:

CONSTITUTION OF THE EARTH

"A Reply to Leon Dominian by Marshall B. Gardner, author of 'A Journey to the Earth's Interior, or Have the Poles Really been Discovered.'

"When I sent out my little book I expected some very drastic criticism at the hands of scientists. I knew that the great majority of scientific men would not believe as I have come to believe in this matter. I also thought that they would not only express that disbelief, but back it up with arguments, and

modify some of the details in my theory, or at least find more suitable ways of expressing its essential facts.

"May I say at the outset of my answer to the member of the American Geographical Society's staff who has written about my book in the *Leader* that if his position on the staff of that society means that he speaks with the authority of orthodox science and as a representative of that science, then I am astonished at the feeble resistance to the new idea which orthodox science is putting up. That feebleness I shall now proceed to point out by taking up Mr. Dominian's points in order and answering them. I shall then mention a thing or two that he has apparently been quite unable to answer and has left unanswered, although his doing so robs his reply of all claim to be a really comprehensive answer to my arguments.

THE MAMMOTH

"First: Mr. Dominian first attacks my evidence based on the finding of the mastodon in a state of perfect preservation. He says these animals are found imbedded in polar ice because once upon .a time the polar lands, where their bodies are now found, were tropical. In those tropical lands they lived and had their being, then all of a sudden some disturbance caused the axis of the earth toward the equatorial circle of the universe to change suddenly and turn the tropical regions of the poles into their present conditions of a world of snow and ice, and that the mastodons were caught and preserved by this change, death coming instantly to those that have been found as whole bodies.

"'Well, I do not pretend to understand all of the above, especially that phrase, 'the equatorial circle of the universe,' my common sense judgment tells me that it is highly improbable. In the first place we note that Mr. Dominian only believes this--he does not prove it. Now the only theory of a sudden change in the earth's axis for which scientists have ever claimed to have a shadow of proof is that change which they assert took place when the moon was separated from the surface of the earth. I doubt very much if that ever took place because the depths of the oceans on earth are hardly enough to account for the tearing away from the earth's surface of such a body as the moon. But even if that sudden change did take place it occurred many million years before there were any mammoths. 'Oh, well,' Mr. Dominian may reply,

'There was another sudden change after life had reached the point where the mammoths did inhabit the northern region.' Well, suppose there was. Why, then, are the mammoths alone preserved, and not the tropical vegetation and surroundings in which they were when the sudden change came? If the mammoth which I described in my book, which was caught while it was eating, was preserved so well that the very food between its teeth was identifiable, then why was not the food also preserved which had not yet been lifted from the ground--why was none of the surrounding foliage preserved? It is quite obvious that Mr. Dominian's belief of a sudden change fails altogether to meet my point.

THE RED SNOW

"Second: My critic's next point is that the red snow did not come from the interior of the earth, but was pollen. He admits that it was blown from other places, just as the sand of the Sahara is blown across the Mediterranean to Southern Europe.

"Now this is an interesting comparison, but it is not a complete parallel. In the first place Mr. Dominian knows where the sand comes from, but he does not pretend to say where the red pollen comes from. And what is more, if he did try to say where it came from he would solve the problem of its origin--and that has not yet been accomplished. But suppose we agree with him that it comes from a great distance, then why should it have such a strange affinity for the polar regions? Why should it not be blown to Southern Europe or Pittsburgh? Strange that magnetic attraction of the polar regions from a mysterious and great distance.

ASTRADDLE A FLOATING LOG

"Three: With my critic's next objection I have less fault to find. In fact it is the most logical in his whole paper. He says that there is no special significance in finding the trunk of a tree from the temperate zone floating in the Arctic Sea, the vagaries of floating objects being too common for that find to create a theory of a new world.

"Now isn't that true? Don't we just have to bow down before Mr. Dominian and assure him that he has indeed proved for all time that anyone

who founds a theory of the world on a floating log is indeed a fool? Logic so compels us, and we do. Even Newton would hasten to deny that he founded the theory of gravity on the falling of an insignificant apple if he were to hear that argument. But if Mr. Dominian is not merely laying down a general truth here, but trying to imply that I founded my theory on a floating log, then I must protest against his method of attacking an opponent, for I merely mentioned that log as an interesting little piece of corroborative evidence, and Mr. Dominian makes the most of it.

A FEW POINTS HE FORGOT

"By contrast let us see how much he makes of my direct ocular evidence from Mars, and which applies of course to every planet in the stellar universe. I cannot see any mention of it, for in all of his reply he has not deigned to discuss the matter at all.

"Well, perhaps he has shown where I am wrong on the Aurora Borealis. No. I fail to find any mention of that in his answer.

"And yet he calls his remarks a reply to my theory and ventures on the strength of them to assail my theory as impossible.

"Mr. Dominian himself admits the open polar sea, but he does not make any illuminating comment on it or explain why there should be such a warm sea around the North Pole. Except on my theory this is one of those puzzles which the orthodox scientists may have a job to solve.

"In conclusion let me say that I do not claim to speak as a trained scientist in putting out my theory. I have had no observatories or subsidies, nor years of training along scientific lines to assist me in these investigations. To the criticism that amateurs attack great problems which true scientists leave alone which has been said about me--all I can reply is that the evidence makes the problem. I did not make up this theory out of a few mathematical formulas and a vivid imagination. I simply saw the facts and put them together. Any attempt to argue from the question of my equipment as a scientist is futile. I have stated the facts. Can they be explained in any other way? I answer, No."

WE NEVER HEARD FROM HIM AGAIN

Well that is our answer to Dominian, and as we have said, above, we never heard from him again. That his attempt to overthrow our theory was ridiculous is perfectly evident. We might have said more than we did in answer to him, but what we said was sufficient.

For instance, we might have added to our remarks on the mastodon, that if the axis of the earth had shifted with such suddenness as to freeze them instantly--which could not have happened anyway--but even if we suppose that it did, the enormous centrifugal force evolved would have lifted the beasts from the surface of the earth and as they fell they would have been dashed into fragments.

CHAPTER XXIV. OUR COUNTRY AND OUR THEORY

We have opened the road to a new world in our theory and it must be a world of inconceivable richness. When we think of the untapped richness of mineral resources that must exist in such a region, of the untouched veins of gold that may run down from the scanty traces which we painfully mine on our outer surface--which we dig out so slowly that, work away for years as we do, the visible supply of gold never gets much beyond the consumption so that for thousands and thousands of years it has been a precious metal and a standard for money values when we consider that those scanty veins may be but the outermost traces of what in the interior are immense deposits; when we think of the other precious metals whose fields are so strictly limited on the outer surface; when we think of the decreasing deposits of diamonds and other precious stones which may be supplemented by those of the interior the imagination is staggered. And those are only the most obvious sources of wealth. It is little recognized, but true, that iron deposits and rich sources of fuel and food are just as much treasure trove as gold and precious stones. We do not know what new food products beside the mammal and many species of fish we may find in the interior but there must be many. As a land it must more than teem with milk and honey. It must be alive at every point with animal and vegetable life. Its seas must also teem with creatures that are not known to us at the present day on the outer surface although we do see the fossil remains. These creatures are undoubtedly edible as they are so closely related to forms of present day life that are edible. The vegetation of the interior of the earth is practically the same in all probability as the outer-earth vegetation used to be in the Carboniferous period--the vegetation which, fossilized, gives us our coal measures today. Now this vegetation has been growing in the interior for hundreds of thousands of years, perhaps, certainly for tens of thousands, of years, and its successive growths and decays have undoubtedly formed vast peat bogs similar to those in Ireland and other countries that yield much fuel to-day. These peat bogs are really the first stage in the formation of coal beds, and if we could get to those on the interior today we should have all the coal or near coal that we wanted, enough to supply the wants of the world for years to come--for years after our

present coal mines were exhausted. The richness of that one item in the wealth of the interior of the world must be incalculable.

UP TO THE UNITED STATES

For economic reasons, then, as well as for the advancement of science and the glory of discovery, it is of the utmost importance that the interior of the earth should be explored.

And let the reader note well that the interior will, by international law, belong to the country which first penetrates it and plants its flag there.

The real discovery of the interior has been made by a citizen of the United States--has been made in this book. But that fact will cut very little figure if another country gets its flag in first. And the scientists of all the civilized countries in the globe have read our theory. To be sure they read it in war-time. Europe and Japan were both busy. No time or men could be spared to take advantage of this opportunity. But the war is, at length, over. Things are becoming normal again. European countries are fully awake, more so than ever before, to the need for territory--they are nearly enough bankrupt so that any chance to recuperate their fortunes is not to be turned down without hesitation. And their hesitation will be brief when they realize that all they have to do is to equip an expedition consisting of two or even one ship and a couple of æroplanes, and fit them out for much less than a year's voyage. The ship will carry the supplies and the æroplanes as far north as practicable. Then the aviators will put forth, flying so quickly over the cold barrier that they will hardly suffer from it at all. And once they reach the interior the thing is done. The flag is planted. The land is claimed, and America's chance at it is gone forever. And who can doubt that if America gets this land, America with her high civilization, her free institutions, her humanity--for there may be native population to deal with--her generosity--who can doubt but that if my country is first in this new land the outlook for the greatest benefits from it is most bright? Do we want one of the autocratic countries of Europe to perpetuate in this new world all the old evils of colonial oppression and exploitation?

No, let the world that an American has discovered be opened to the rest of the world by American enterprise. In that way its benefits will be to all the

world and not to a few, not to a privileged nation or class.

WILL AMERICA GRASP HER OPPORTUNITY?

But will America grasp her opportunity? In that question, reader, lies something for you to ponder. While we live in a great and enterprising country, a free and enlightened country, our greatness and enlightenment and initiative reside more in ourselves as individuals than in our government. The nations of Europe are used to have their governments do this and that for them. We have relied more on our own efforts, and consequently our government does not have the quality of initiative that other governments have. We have spoken of what some European or even Asiatic governments may do. Is our own ad-ministration likely to do it first? The answer is not until public opinion makes it take action. Unless some private citizens club together to form an expedition

--as in the past they have supported several Arctic exploring expeditions--unless they do this, the government is hardly likely to undertake it of its own initiative. The only way in which the government could he made to do it would be the agitation of the subject in congress, and if that were undertaken by enlightened senators or representatives the government could then, through the navy or some other department, appropriate money and select men to carry on the expedition.

But there is one danger to guard against here. 'We have a habit in our legislatures of discussing things at wearisome length before we get any action on them. And the very conservative among our legislators would likely enough disapprove of any such programme as we have outlined. There is always a lot of unintelligent opposition to scientific research among our senators and representatives. Now the discussion of this matter in congress would be reported all over the world, and the moment the European nations saw that we intended to explore the interior of the earth they would get in ahead of us.

WE MUST NOT DELAY

So it is obvious that however we go about this matter of exploration we must not delay. Opportunity knocks once in many cases, and never knocks

again if she is not admitted. We already know enough of the Arctic regions so that the expedition could start without much preliminary investigation. The best approaches are known. What we should need in supplies is known. We know roughly what to expect when we reach the interior. We know that it is possible to cover even such a distance as the Atlantic flight in a plane. So we know how powerful a plane would be needed and how much fuel for this relatively short voyage. A first voyage, of course, would be only exploratory and designed to get information upon which a more detailed and heavy expedition and survey could be made. The chief thing would be to verify those discoveries and get the flag. planted. After that one of the largest exploring expeditions in the history of the world would be called for. And it would be immediately followed by the establishment of regular freight routes and the organization of means of exploiting the resources of the new world.

But may the author beg his readers to regard this from a patriotic standpoint and to do their level best to see that their country is not left behind in the matter? We would like to have letters from all who sympathize with our endeavors to have this new world explored.

It may be objected that the present is no time to burden our already over-burdened government with fresh enterprises and our tax payers with new appropriations. But that is a very superficial objection. If the government authorized an expedition it could be undertaken by the regular naval or coast survey forces already enrolled in government service and on the government pay roll. The ships and aeroplanes required are also already paid for. The only extra expense would be for supplies. And the actual results of a successful expedition would far outweigh even the largest possible expenditures. A new territory almost as vast as that which the world occupies now would be opened to mankind. How much of it America could claim is problematical but she could certainly claim a tremendous area. The minute we began to take the riches of this area from the interior to our own country our national wealth would increase tremendously. In fact the whole burden of poverty would be lifted. There would be new careers for all who wished them. A new world would mean the disappearance of most of the woes of the present half-world on which we dwell, ignorantly taking it to be the whole world.

A BENEFIT TO MANKIND

Such is the opportunity that confronts us as a nation. Every patriot who is also intelligent must see that to help realize this opportunity is in itself to be a patriot just as much as if he were helping on the field of battle. In fact everyone who helps in this enterprise will be helping on a field of battle the battle for subsistence, for plenty, for progress, for supremacy, for all that makes life worth living. For this discovery would add the most glorious page yet written to the annals of the United States. It would place us first among the nations in intellectual glory; it would even enhance the supremacy which we already enjoy in the material sphere. We talk of helping to feed Europe. Once we have made this discovery in actual physical fact--as it is already made in reason and thought--feeding Europe would be a mere bagatelle. We could feed the world and have an unlimited plenty left over. We not only could feed the world but we would transform the world. A new and glorious chapter in the history of the human race would have opened.

CHAPTER XXV. IN CONCLUSION

We have now stated a theory of the constitution of the earth and of all the other planets, and this theory seems to account for every fact that scientists have recorded as a result of their observations. This theory either represents the truth of the matter or it does not. But if it does not represent the truth what is the truth? What the orthodox scientists have told us? Any time that the orthodox scientists will explain to us the following phenomena as fully as our theory explains them, we will be willing to abandon our theory. But until they can explain them in a consistent way--that is to say not merely explain one thing by an argument that is overthrown by some other thing, for instance not explain the polar cap of Mars by some explanation which has to be abandoned when they come to that of Venus--until they can do that we are fully justified in claiming that our theory is the only one that explains all the observed facts of the planetary universe.

QUESTIONS THE SCIENTISTS MUST ANSWER

And so any scientist who wishes to dispute our theory ought to be able to solve the following mysteries--for mysteries these things are and always have been to orthodox science.

WHY POLAR CAPS ON VENUS?

First: Why does the hot planet Venus have polar caps like those of Mars if the Martian caps are really composed either of ice, snow or frozen carbon-dioxide? Also, why do the polar caps of Venus and Mercury not wax and wane as those of Mars are said to do? And why are the polar caps of Mars seen to throw a mass of light many miles above the surface of the planet when they are seen in a side view if they are only of ice? How could they be so luminous in the first place--more luminous than snow is when seen under similar circumstances? And how could Lowell see direct gleams of light from the caps if there were not beams from a direct light source?

Furthermore, how do scientists account for the fact, noted also by Professor Lowell, whose observations on Mars all seem to support our

theory, that when the planet is viewed through the telescope at night that its light is yellow and not white, as the light from snow caps would be? The central sun is an incandescent mass, and just as the glowing of an incandescent electric light looks yellow when seen from a distance through darkness, so the direct light of the Martian sun would appear yellow--but if this light were reflected from a solid white surface it would certainly appear white. But it does not, and so it is up to the scientists to tell us just why it does not. But so far as we know they have not succeeded in doing this.

PLANETARY NEBULAE ARE HOLLOW

And why have scientists never really considered the problem of the shape of the planetary nebula? They know from actual observation and photographs that the planetary nebula takes the form of a hollow shell open at the poles and having a bright central nucleus or central sun at its center. Why have they never thought what that must imply? It is evidently one stage in the evolution of the nebula. Why have scientists never asked themselves what that conformation must logically lead to? Why do they ignore it altogether? Is it not because they cannot explain it without too great a disturbance of their own theories? But our theory shows how that stage in the evolution of a nebula is reached and how it is passed, we show what precedes it in the history of the nebula and what follows it. We show a continuous evolution passing through that stage to further stages in which those polar openings are fixed, the shell solidified, the nebula reduced to a planet. And it must be remembered that while the original nebula was incomparably greater than a planet in size, measuring even millions of miles across perhaps, at the same time that nebula is composed of gases so attenuated and so expanded by their immense heat that when they solidify they only make one planet.

HOW EXPLAIN THE AURORA?

Why have scientists never compared the facts of the light cap of Mars with the light that plays over our own polar regions? Do they forget that the auroral display has been observed to take place without any reference to the changing of the magnetic needle? And if the aurora is shown to be independent of magnetic conditions what else can it be due to than a source of light? Is not the reflection of the aurora light from the higher reaches of the

atmosphere comparable to the projection of the light of the Martian caps into the higher reaches of the Martian atmosphere? And how do scientists explain the fact that the aurora is only distinctly seen in the very far north and only seen in a fragmentary way when we get further south?

How do scientists explain the fact that when we go north it becomes colder up to a certain point and then begins to get warm? How do they explain the further fact that the source of this warmth is not any influence from the south but a series of currents of warm water and of warm winds from the north--supposed to be a land of solid ice? Where can these currents come from? How could they come from anything else but an open sea? And why should there be a warm open sea at the very place where scientists expect to find eternal ice? Where could this warm water possibly come from?

FROM WHERE DOES THE RED POLLEN COME?

Why also should explorers find the inhospitable ice cliffs of the far north covered in large areas with the red pollen of an unknown plant? And why should they find the seeds of tropical plants floating in these waters--when they are not found in more southern waters? How should logs and branches of trees, sometimes with fresh buds on them be found in these waters, all being borne down by the warm currents from the north?

Why should the northern parts of Greenland be the world's greatest habitat of the mosquito, an insect which is only found in warm countries? How could it have got to Greenland if *it* came from the south? Where do all the foxes and hares go which were seen traveling north in Greenland? Where did the bears go? Was it possible that such large creatures as bears could find sustenance on plains of eternal ice?

HOW ABOUT THE MAMMOTH?

Scientists admit that the mammoth lived on the outside surface of the earth somewhere around 100,000 years ago. That being the case, why are mammoth carcasses found in Siberia which are perfectly fresh? If they were killed by their climate changing from semi-tropical to frigid 100,000 years ago, would not their freezing be so gradual that they would decompose before it took place? Is not the fact that fresh grass is found between their teeth proof

positive that they were frozen immediately? Does it not prove that they were alive and eating one minute, precipitated into an ice cleft the next minute and frozen just as fast as the ice could do it? And if these tropical animals were alive and in the neighborhood of ice crevasses does it not mean that they were traveling and that they had a base from which to travel, or a habitat, which was not itself icy but tropical, seeing that this animal is a tropical and not an arctic animal? Have scientists ever given any consideration of those facts, or have they been afraid of them?

How do scientists explain the Eskimo traditions of other strange animals in the Arctic, for instance, the animal which the Eskimos call the arcla, and which they described to Captain Hall? And how do they explain the remains, in good condition, of such a supposedly prehistoric animal as the mylodon which was found in the Antarctic by Nordenskiold, and which is known to be a type of animal that lives in a warm country?

WHENCE THE HUMAN REMAINS IN THE ANTARCTIC?

And how do scientists explain the actual finding of human remains in the Antarctic? So far as we know they have not even tried to explain it, but the remains were found and no doubt has ever been cast upon the integrity of those who found them. And as we have shown in our chapter on the Antarctic, much of the fauna and flora of the southern islands comes originally from the Antarctic, and only on our theory can an original starting place be assigned to it.

How do scientists explain the fact that practically every competent explorer from the earlier days down to Nansen has admitted that when he got to the far North his theories of what he should find failed to work and his methods of finding his positions also failed to work? How do scientists explain those passages from Nansen which we have quoted, showing that he was absolutely lost in the Arctic regions?

How do scientists explain the migrations of those birds which appear in England and other northern countries one part of the year, in the tropics another part of the year, but disappear entirely in the winter? How do they explain the fact that neither Peary nor Cook was able to prove the claim of reaching the north pole? Even supposing both men to have acted in good faith

is it not obvious that both were lost? How else explain the discrepancies in Peary's own narrative which we have exposed in a previous chapter?

THE PUZZLE OF THE MOON

And here is another puzzle which the scientists might well be asked to solve before they disdain the contributions of one who is not a member of their guild or union. Some scientists, for example, Proctor, say that the moon was originally a free planetesimal body which has been captured by the earth. Other scientists--among them Pickering--have claimed that the moon was thrown off from the earth's surface in an early stage of the history of the planet. They point to the Pacific coast bed as the depression that was left. But as the mass of the moon is about one-eightieth of the mass of the earth and the total of all the ocean beds a mere infinitesimal fraction of the earth's mass it hardly looks as if this theory were correct. At any rate the scientists have not yet succeeded in settling the matter to their own satisfaction. One more example, we should say, of the fallibility of science.

In short, how do scientists explain the whole general situation put up to us by the discrepancies between actual findings in the polar regions and their theories? The answer is that they do not try to explain these things because they are quite unexplainable on their scientific basis.

And so the scientists cannot tell just what to do with our theory. One policy is to ridicule us. For instance one professor of geology said that our book was "a great joke." Perhaps it is, but the joke will be found to be on the scientists.

This does not mean, however, that our theory is not scientific, and that we do not believe in the work of scientists. On the contrary it is on scientific observation that our theory is built. The people whom we quote in substantiation of our theory are themselves scientists. Many scientists, as we have shown in another chapter, view our theory with sympathy. Our criticisms of the scientists, therefore, are confined to those among them who neither accept our theory on the one hand nor give any real reason for not accepting it on the other hand. From these men who are no longer really scientists because they do not display that spirit of fair-minded openness to conviction that really makes the scientific spirit--from these men we appeal to

those others who really deserve the name of scientists because they are still alert and open to conviction and able to change their minds whenever the evidence makes it necessary.

And so our last word to the scientists is this: We are not prejudiced against science and have not tried to make good our theory by any other way except that of collecting indubitable evidence--that is by the scientific method. Further, we are very anxious to have scientists of every shade of opinion try to upset our theory if they can or verify it if they can. But we do not want any scientists to make mere vague objections, simply saying, as some have done, "There are many reasons why this theory cannot be true." Perhaps there are, but what are those reasons? That is the question we want them to answer. We have asked for specific objections to our theory, we have tried hard to get at these reasons, and every scrap of objection that the scientists of the world--not of America only--have been able so far to advance against our theory, every scrap of such objection is to be found set down in this book--and answered. Let the reader turn again to the chapter in which we refer to these objections. Is it not surprising that they are so few? Is it not amazing that the great intellects--at least we would suppose them to be such--which dominate our universities and teach our youth, and plan our explorations and turn telescopes upon the stars, is it not amazing, we repeat, that these people have not been able to muster up any stronger reply to us that that? And we have given them every facility, we have written them, showed them our arguments, and have had some of their replies for years, before publishing this book.

Well, they have had all that opportunity and this is the best that they have been able to do in reply.

So now let us suggest that they try to help our theory, since they cannot demolish it. Let us ask them to turn their arguments and make observations in support of our theory. For we wish to have the co-operation of science in discovering and opening up this great new world, and we are sure that public opinion will get behind us and aid us in calling upon the scientists to take a stand definitely upon our challenge--for it is a challenge that we throw down to the scientific world--a challenge to disprove our theory if it can, and failing that to admit frankly that this theory is a step in advance of the scientific conceptions of the present day. And such admission would not be a blow to

the prestige of science. On the contrary it is the glory of true science ever to advance, ever to welcome new truths, and we have confidence that the publication of these arguments will cause some at least of the scientists of today to rally to our side.

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